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A COLONY OF BUTTERFLIES.

BY AUG. R. GROTE.

ABOUT one hundred thousand years ago, during the decline of the ice period, a colony of butterflies settled in New England. They chose for their territory Mount Washington, in New Hampshire, and their descendants occupy the rocky summit of that mountain to this day. Mount Washington is 6293 feet high, and the White Mountain butterflies are not found below an elevation of about 5600 feet. Between this height and the cloud-capped summit, the butterflies disport during the month of July of every year. The bare and inhospitable summit affords little vegetation, but the White Mountain butterflies find there food upon which they thrive. Both Mr. Sanborn and Mr. Scudder have found the caterpillar feeding upon the sedges which grow, as best they may, in hollows and between the rocks. The brown butterfly which succeeds the caterpillar measures about one and eight tenths inches from tip to tip of the extended fore wings. Above, the wings are feebly marked; beneath, the hind wings are crossed by a dark median band with its outer edges deeper brown and irregular, while beyond the band the wings are marbled, brown and white. Naturalists know the White Mountain butterfly by the name of *Oeneis semidea*, and its first biographer was Thomas Say, who described it in the year 1828. Previously, Mr. Thomas Nuttall, the botanist, had collected specimens of the butterfly, while Say's original figure of the species was drawn from an individual presented to him by Mr. Charles Pickering, of Salem.

It is 1800 miles west from Mount Washington to Long's Peak, Colorado. In this direction, over all the level stretch of country, no butterflies like our White Mountain butterfly are to be met with. But in Colorado, species similar to the White Mountain butterfly, if not exactly like it, are found again occupying ele-

vated lands. To the northward it is 1000 miles to Hopedale, Labrador, and here again very similar butterflies are found living in that northern region.

This is a strange distribution for a butterfly, and so the question comes up as to the manner in which it was brought about. By comparing what has been found out with regard to past conditions of the earth and the present state of things, a solution of the question has been offered. This solution gives us the ice period in North America as the agent which has induced the present distribution of the genus to which the White Mountain butterfly belongs. And the colonization of the butterfly on our New England mountains would have been effected in this wise.

Before the ice period commenced in New England, it had gathered in the extreme north of the continent. The ice gradually and very slowly advanced year by year to the southward. Always more snow fell than was melted, and this snow stayed summer and winter, and accumulated more and more. It consolidated into *nevé* and glacial ice. Forming on the highest lands, the ice-rivers filled the ravines and joined upon the plains the main body of ice which was pressing southward from the pole. Summer and winter still alternated, but, as is the case now at the extreme north, the summers were short and the winters long. The advancing ice destroyed or drove before it the insects and animals of the warmer climates, which it chilled by its approach. But it was kind to its own children. It brought down with it its *Oeneis* butterflies and its reindeer. Before its feet it spread food for both of these, year by year, always pushing food and animals to the south. At the probable rate of less than a mile in a hundred years, it brought them at last into Virginia, from the farthest north; not the Virginia of to-day, but Virginia changed into an Arctic scene.

At length the climate changed. The point of farthest advance reached, the ice began to retrace its steps. And it called its own back with it, alluring them by their food, scattered ever farther and farther to the north. At some time the lengthening summers and shortening winters brought the main ice sheet back into New England. From Southern New York to Connecticut, to Massachusetts, to Vermont, to New Hampshire, it retreated all the way. It was as the retreat of an army with all its baggage and equipments, and in perfect order. Year by year it called upon its plants, its butterflies, its animals, and they followed in its royal train. It had overridden all obstacles, all lives and

constitutions, and in its retreat it shed, over the lands which again saw the sun, floods of water, the source of fresh life and civilizations. But it was careful of its own plants and animals; they were to go back with the ice, nor be seduced by the lakes and streams its retreat unveiled, and so become companions to the mammoth. And it succeeded, for the most part, until it reached the White Mountains. Though year by year the individual butterflies perished, they planted their successors; the longer-lived reindeers laid their bones by the way, and in the Connecticut Valley itself, but fresh herds still were ready to follow the northward march of the great glacier.

Out of the valley of the White Mountains the main ice mass gradually retreated; and here it lost some of its followers. At that time the White Mountains must have presented an appearance not unlike the Alps of to-day, an aspect which, owing to their inferior elevation, they have since lost under a climate growing in warmth. The local glaciers, which then filled the ravines, attracted some of the wayward, flitting *Oeneis* butterflies by a display of the food plants which they had harbored and detained from the main glacier. Year after year the great glacier retreated farther and farther north, followed by the main body of its train, — plants, butterflies, and animals, — the while some of these foolish butterflies were beguiled by the shallow ice-rivers which then filled the ravines of Mount Washington. Return became at length impossible. They advanced behind the deceiving local glaciers step by step up the mountain-side, pushed up from below by the warm climate, which to them was uncongenial, until they reached the mountain peak, now bare of snow in the short summer. Here, blown sidewise by the wind, they patiently cling to the rocks. Or, in clear weather, on weak and careful wing, they fly from flower of stemless mountain-pink to blue-berry, swaying from their narrow tenure of the land. Drawn into the currents of air that sweep the mountain's side, they are forced downwards, to be parched in the hot valleys below. Yet they maintain themselves. They are fighting it out on that line. They are entrapped, and must die out there by natural causes unless certain entomologists sooner extirpate them by pinning them up in collections of insects. What time, in Tuckerman's Ravine, I see the ill-advised collector, net in hand, swooping down on this devoted colony of ancient lineage and more than Puritan affiliation, I wonder if, before it is too late, there will not be a law passed to protect the butterflies from the cupidity of their pursuers.

This is the story of a colony of New England butterflies. I commend this colony to the protection of all good citizens of the State of New Hampshire.

THE GAME FALCONS OF NEW ENGLAND: THE GOSHAWK.

BY W. WOOD, M. D.

ALTHOUGH this bird (*Astur atricapillus*) has not the characteristic markings of the true falcon, yet it can be trained to capture game. It was considered by Audubon, Sabine, and others to be the same as the European goshawk, which was so highly prized for sporting. Says Wilson, "If this be not the celebrated goshawk formerly so much esteemed in falconry, it is very closely allied to it." The poet Chaucer in alluding to it says, —

> "Riding on hawking by the river,
> With grey goshawk in hand."

Falconry and hawking, as defined by our lexicographers, are synonymous, but formerly birds of sport were divided into two classes, those of falconry and those of hawking. This bird came under the latter class. Mr. Pennant informs us that "the goshawk is used by the Emperor of China in his sporting excursions, and is considered the best of all hawks for falconry." The same writer further says that he "examined a specimen from America which was superior in size to the European." Whether the American and the European are identical I am unable to say; but many of our ornithologists at the present time consider them specifically distinct. Until quite recently, the tendency of ornithologists has been to make as many new species out of one bird as possible. Every change of locality necessitating a different construction of nest, and every slight change in color, arising from climacteric causes, has been seized upon to create new species. Happily for science there is now a reaction taking place among our best ornithologists. Says Professor Baird, "I take more pains now to subordinate forms once considered specific, than I do to establish them as such." It is not impossible or even improbable that our goshawk may yet be considered identical with the European species, and our perigrine falcon with its European congener. The goshawk is the handsomest of all our rapacious birds, and is so beautifully marked as to be easily distinguished from all our hawks. It is not very common in any part

of the United States, but Cassin informs us that "it is apparently more abundant in Northwestern America than in any other portion of the United States." His opinion was based upon the fact of six specimens being captured by the Pacific Railroad survey parties in Washington Territory and Shoal Water Bay. It may have been abundant that season and not seen there again for many years. Professor Verrill says that "it is common in Maine, and breeds there." Mr. G. A. Boardman, of Maine, says, "It is the boldest and most common of our winter hawks."

Some winters it is abundant in Connecticut, and the most common of our hawks, and then for years not a single specimen is seen. The first specimen which I obtained in East Windsor was in the winter of 1849–50. He was caught in a trap and brought to me alive. I gave him his liberty in a room eight feet by twelve feet, with a good supply of food, which he utterly refused to touch until the thirteenth day, when he devoured an entire hen, and died the next day, a victim to his voraciousness. The next that I received were two specimens in the winter of 1859–60. Nuttall speaks of its being very rare in Massachusetts; yet in 1859–60 Hon. C. L. Flint, of that State, received twenty specimens. It did not visit us again until the winter of 1867–68. That season I mounted five specimens and sent away quite a number for exchanges. I probably received some twelve or fifteen during the winter. In the winter of 1868–69 I received nine, and in 1869–70 two specimens. Since 1870 none have been taken or seen in this section, and it may not visit us again for another decade.

The goshawk does not usually soar high, like the longer-winged hawks, nor dart upon its prey by a direct descent, as do the true falcons, but by a side glance. It is restless, seldom alighting but for a moment, except to devour its quarry, and then it stands almost erect. Its flight is so rapid that it can easily overtake the swift pigeon on the wing. Audubon relates the following fact that he was an eye-witness to: "While traveling along the Ohio I observed a goshawk give chase to a large flock of crow-blackbirds then crossing the river. The hawk approached them with the swiftness of an arrow, when the blackbirds rushed together so closely that the flock looked like a dusky ball passing through the air. On reaching the mass, he with the greatest ease seized one, then another, and another, giving each a squeeze with his talons and suffering it to drop upon the water. In this manner he had procured four or five before the poor birds reached

the woods, into which they instantly plunged, when he gave up the chase, swept over the water in graceful curves, and picked up the fruits of his industry, carrying each bird singly to the shore."

The goshawk is the most daring and venturesome of any of our diurnal birds of prey. A farmer who resides a few miles from my office, wishing to perpetuate the old New England custom of having a chicken pie for Thanksgiving dinner, caught some fowls, took them to a log, severed the neck of one, and threw it down beside him. In an instant a goshawk seized the struggling fowl, and, flying off some ten rods, alighted and commenced devouring his prey. The boldness of the attack so astonished the farmer that he looked on with blank amazement. Recovering from his surprise, he hastened into the house and brought out his gun, which secured him both the hawk and the fowl. Another instance of still greater daring occurred near East Windsor Hill, Conn. A goshawk flew after a fowl near a dwelling-house ; the door being open, the hen flew inside ; the hawk followed, and seized her in the room occupied by an old gentleman and his daughter. The old man hastened to the rescue, and struck the hawk with a cane before it released its grasp. The daughter caught the hawk as it attempted to fly out of the door, and killed it.

When looking for prey it skims along near the surface of the ground with great velocity, and catches its game so quickly and easily as scarcely to be seen by the looker-on. The female is nearly one third larger than the male, and the young measures considerably more than the adult bird. I have specimens of the goshawk of all ages from the young to the adult, but am not aware that it is known when this bird arrives at adult plumage. I have kept the young in confinement until one year old without its showing the least tinge of gray or slate-color. No one but an ornithologist would ever suspect that the young and the adult belonged to the same species.

With regard to the nest of this bird, says Audubon, " The goshawk is of rare occurrence in most parts of the United States, and the districts of North America to which it usually resorts to breed are as yet unknown. Some nest within the Union, others in the British Provinces of New Brunswick and Nova Scotia, but the greater part seem to proceed farther north." The nest is said to be quite large and flat, and placed on the high branches of a tree, near the trunk, and is composed of dead twigs and coarse grass, lined with fibrous strips of plants, and sometimes with a few feathers. The goshawk lays from three to four eggs, usually

of a dull bluish-white color, and slightly spotted with faint brown blotches. One of the eggs in my collection is of a dusky white color, slightly tinged with dull blue, with oblong blotches of greenish-blue, and quite granulated. The measurements of two taken from different localities are as follows: long diameter $2\frac{3}{10}$ inches, short diameter $1\frac{7}{10}$; the second one, $2\frac{1}{8}$ inches by $1\frac{5}{8}$ inches. These measurements are somewhat less, and the egg was less spherical, than the one described by Dr. Brewer in his North American Oölogy. After thirty years' observation and experience in ornithological and oölogical researches, I am satisfied that it is not wise to place too much reliance upon the measurements or number of eggs found in a nest. This is particularly the case with our rapacious birds. Take for instance the great horned owl. Audubon says that it lays from three to six eggs; another collector says it always lays two eggs. While this may seem inexplicable to some, it admits of a very easy solution. A pair of these birds will occupy the same piece of woods for years if not molested, and the collector who finds their nest will invariably find two eggs. I have found two, three, four, and five eggs in a nest of this bird in different localities. The old bird lays two eggs, while the younger bird lays the larger number and the smallest eggs. I have never seen these facts in print, and am not aware that they are known to oölogists, but they are based upon my observations and that of my collectors. They explain many seeming discrepancies, and for this reason I have digressed somewhat from my subject in order to give what I consider important facts to the oölogist, as this closes my series of articles on the game falcons of New England.

THE ORIGIN AND DEVELOPMENT OF MUSEUMS.[1]

BY DR. H. A. HAGEN.

THE second part of the seventeenth century is remarkable for the formation of academies in nearly every great city, and some, principally in Italy, were founded even a century before. The first one, the Academia Secretorum Naturæ, founded in 1560 in Rome, was soon suppressed by the popes as being dangerous. Of those founded in the seventeenth century, some were more successful, and the most prominent are still vigorous, as, for instance, the Royal Society in London, the Leopoldine Academy in

[1] Concluded from page 89.

Germany, and the Academy of Sciences in Paris. These three, founded nearly at the same time, between 1660 and 1670, have published their valuable transactions during two centuries, containing an immense number of facts and speculations which prove clearly that union is power. The facility of publishing isolated facts, otherwise lost, advanced science and her tools, the collections, in a remarkable degree. Naturally, from this time forth, new societies were founded year by year, all doing more or less valuable service.

In the mean time a very important discovery was made, that of the microscope. Formerly, natural history consisted only of observations made with the naked eye, but now the field of observation was enlarged in a manner not dreamed of before. Of course collections, becoming by degrees living archives of science, were allowed to be established on a larger scale.

It is well known that magnifying-glasses have been found among the Assyrian relics and the ruins of Pompeii, but the use of their magnifying power is nowhere recorded, though it is probable that some of the admirable gems of the ancients were cut with the help of lenses. Spectacles, perhaps in some way known in Rome, and even used by Nero, are said to have been invented at the end of the thirteenth century in Italy. Magnifying-glasses were manufactured by Arabians, and later by Roger Bacon, but certainly not used for the purposes of natural history before the beginning of the seventeenth century. Italy and Holland dispute the honor of the invention, which was perhaps simultaneous in the two countries. The great advantages of lenses for observation were directly acknowledged, and even augmented, by the invention of the compound microscope. Fontana in Rome and Drebbel in Holland are the rival inventors.

The old fame of Italy was now declining, and religious fanaticism hindered more and more the development of science. Unfortunately, also, the famous wealth of the Italian merchants was destroyed by the refusal of a number of prominent princes to pay their debts, enormous sums of money advanced by Italian bankers. These circumstances, together with the general change of the old routes of trade, gave an important advantage to the Dutch Protestants. The easily amassed fortune was largely used to advance culture and science, and the small Dutch country became for more than a century the leading nation in fashion, taste, and science, till her French and English neighbors put themselves somewhat roughly in her place. The particular taste

of the Dutch people for accurate and correct work in its exaggerated and pedantic character was well adapted for forming and arranging collections so rapidly acquired by a trade with the whole world.

Naturalists seldom equaled, never surpassed, belong to this interesting time, as Swammerdam, Leuwenhoek, Ruysch, Rumphius, Seba, and others. The observations and collections of microscopical objects by Leuwenhoek and Ruysch have till to-day a world-wide or rather a traditional fame, and are still preserved, partly in London, partly in St. Petersburg. Swammerdam himself gives an interesting account of his way of arranging and preserving the collections which were the pride and marvel of the country, seen and admired by prominent princes, who disputed among themselves the honor of acquiring them. This distinguished naturalist invented the mode of preservation of the most difficult objects by inflation, by drying, by injection, and by different chemicals.

The fame of the Dutch cabinets, as the most prominent of the time, induced Peter the Great to visit and study them carefully. A number of the most renowned, bought by him for enormous prices, were transferred to St. Petersburg to arouse an interest in such studies in his country. There are also a large number of more or less similar and expensive collections in France, Denmark, Germany, and England. The celebrated collection of Sir Hans Sloane was later the nucleus of the gigantic one of the British Museum.

Some details of the celebrated collections of Ruysch and Vincent in Amsterdam would perhaps be of interest as standard examples of the arrangement of collections at this time. The principal room is an immense hall, the high walls of which are furnished with columns, large windows in the upper part, with a gallery supported by caryatides, and the ceiling covered with rich frescoes. Shelves in the wall, or semicircular alcoves, were used for the exhibition of the objects. Large tables extending through the halls allowed of a far more detailed examination of the jars and boxes with which they were covered. Rooms connected with the halls were used for the cabinets, filled with drawers or glass jars symmetrically arranged. The latter contained birds, fishes, reptiles, the egg of a turtle with the embryo supported by the hand of a child, and a crocodile embryo in seaweed. The cover of the jar is of rich silk damask, fastened with elegant silk cords, the color of which is always reported in the

description of the collection, and on the top of the cover are groups of objects arranged in the most extraordinary way; the young of the obstetrical toad dancing on the nose of their mother in extravagant attitudes, butterflies and other insects flying about bouquets of dried flowers, shells grotesquely arranged in clusters and supported by pyramids of corals, and curious dried sea-fishes or sea-urchins are fastened on the top.

The whole arrangement was such as to please the eye of the visitor, often curious, even tasteless, but according with the fashion of the time, though scarcely ever scientific except that generally animals belonging to the same classes were brought together, if the size of the animals or glass jars in which they were placed allowed of it; but this was not often the case.

Printed descriptions with the most costly engravings of the contents of the collections were published, the repeated editions of which show the interest of the public. Some of them, for instance, the plates of the cabinet of Seba, in Amsterdam, were for a long time a principal authority in natural history, and the source from which naturalists obtained their knowledge. Indeed, this time is to be considered a forerunner of Linnæus in bringing together materials which he was to classify, and thus begin a new era in the study of natural history. Considerable progress is now to be noticed in the development of collections of natural history, as well as the attempt to arrange and preserve objects in a manner to secure them against a speedy destruction.

The objects preserved in alcohol are secured by large corks, covered again by different materials to prevent the evaporation of the preserving fluid. Delicate objects, such as shells and fine corals, were placed in drawers, fixed in the bottom in artistical figures, and the insects were mostly preserved in the same way. Insect-pins did not exist till a century later, and in their stead were used needles, and formerly thorns of plants, as we find them even now in the boxes arranged in China and imported from that country. The entire boxes were protected against dust or museum pests by glass covers; or else small boxes, each containing a few insects, or only one, were arranged in larger boxes, a custom prevailing as late as the beginning of this century.

The well-known naturalist, Petiver, pressed the insects as flat as possible, and fastened them between two plates of mica pasted together by slips of paper and fastened on a leaf folded on one side of a large book. This curious collection is still preserved in the British Museum.

The observation of the biology, and the study of the anatomy, of the objects now progressed rapidly with the help of the microscope, and the works of some prominent naturalists of those times are a source of information not yet exhausted. The names of Buffon, Réaumur, Degeer, Roesel, and many others are even now the pride of science in nearly every country. The middle of the last century begins the science of the present time with the immortal works of Linnæus; immense progress was made in the century after, which he foresaw, and it would be almost superfluous to dwell uponthe merits of Linnæus.

But it seems to me that one of his innovations in science has a striking value for the advancement of collections, which has been, I believe, somewhat underrated. The invention and use of his binomial nomenclature allowed a scientific labeling of objects. Formerly all names of objects were designated by the so-called *nomen specificum* (now called a diagnosis), consisting of a dozen words. Linnæus' use of one name (he calls it a trivial one) for the species and one for the genus facilitated the labeling formerly so tedious and wordy. The advantage is obvious. The clear and logical mind of Linnæus not only purified the system, but also enabled him to purge the collections of a considerable number of fabulous and fictitious objects, sometimes a dangerous task. He was obliged to leave Hamburg suddenly, and by night, because he declared and proved the most expensive and rare object of the collection of the mayor of that city to be a fraudulent manufacture. It was a so-called hydra with many heads, the cranium having been made of weasels covered with snakes' skins. The mighty owner of this exceedingly costly object grew furious and threatened to imprison Linnæus as an impostor.

The "printed instructions" for the arrangement of a museum published by Linnæus in 1753 is the first really scientific essay, and has been followed by most naturalists. Indeed, even to-day we find the principles and rules of Linnæus more or less unconsciously followed in many museums.

Linnæus himself built at his country-seat, Hammerby, his museum, a small, square, brick building, on the top of a hill, with a beautiful view from his garden. I was fortunate enough, thirty-six years ago, to visit the place, just after the death of his youngest daughter. Everything was nearly in the same order as left by Linnæus. The collection and library, as is well known, were transferred to England. I saw them afterwards, one small cabinet containing the herbarium, and a similar one the insects

and shells. This souvenir of the great man fills the heart with awe, when one considers the small number of objects forming the basis of his studies and voluminous works.

Among the numerous museums which were arranged according to his system, and described by himself and his disciples, none gratified his pride more than the collection in the Jardin du Roi, in Paris, by order of the king, and against the wishes of Linnæus' celebrated antagonist, Buffon, the director of this institution. It will not, perhaps, be out of place to quote here an account of it given in 1780 by a prominent American, in the letters of President John Adams: —

"Yesterday we went to see the garden of the king, Jardin du Roi, and his cabinet of natural history, a great collection of metals, minerals, shells, insects, birds, beasts, fishes, and precious stones. They are arranged in good order and preserved in good condition, with the name of everything beautifully written on a piece of paper annexed to it. There is also a collection of wood and marbles. The garden is large and airy, affording fine walks between rows of trees. There is a collection from all parts of the world, of all the plants, roots, and vegetables that are used in medicines, and indeed of all the plants and trees in the world. A fine scene for the studious youth in physic and philosophy. It was a public day. There was a great deal of company, and I had the opportunity only to take a cursory view. The whole is very curious. When shall we have in America such collections? I am convinced that our country affords as ample materials for collections of this nature as any part of the world."

The preëminent value of collections was first recognized when Sweden did not shrink from sending a man-of-war to recover the collections which had been sold in a legal manner to another country. The great advance made by Linnæus was followed by unusual exertions and struggles in nearly every part of the civilized world. Every country had disciples of Linnæus as leading naturalists. Everywhere collections suddenly arose, and only a score of years was needed to recognize that, with the excessive vigor of this time, science had bequeathed a new law of the highest importance for collections: the most careful preservation of described objects, nowadays called types. This new law, seemingly of very small importance, soon gained the most powerful influence over all museums, changing even their interior management and leading in a natural way to more appropriate arrangements.

It became necessary to give to one person the power to govern

and direct the whole; the old custom of having a board of patrons to decide matters concerning the internal management proved to be an impediment, sometimes even a nuisance. It must not be forgotten that, in a regular meeting, the Board of the Ashmolean Museum decided that the bird No. 31 should be thrown away as a rotten object. It was the last Dodo existing. Except in England, and its present and former colonies, such boards of trustees have been abolished.

The aim to preserve everything contained in collections soon demanded a new and most important officer, called conservator. His duty is manifold and burdensome, especially in a rapidly growing museum; the most varied kinds of work belong to him, but all centring in the effort to preserve the treasures of science. In fact, the business of this officer is an art in which there are various degrees of excellence, but in which, as in other arts, no degree of excellence is to be attained without training.

There are a number of scientific matters in which nearly everybody feels himself able to have and to express an opinion, as, for instance, scientific education, local geology, primeval history, management of libraries, and evolution. The arrangement of a museum belongs to the same category, to the detriment of science, which has lost often and heavily by such volunteer efforts. The importance of thorough training for this business is shown by a large and abundant literature. The development of the art of managing collections in the manner above stated was followed, curiously enough, in a natural way by the exclusion of the non-scientific public from them. The inevitable and perhaps irreparable loss of important specimens by persons not accustomed to handle such objects and ignorant of their value, together with the impossibility of securing all objects without impeding their exhibition, was the reason for excluding everybody except naturalists. If we consider that every kind of exhibition necessitates large expenses for large rooms, and for arrangements convenient if not showy, and that just this time of progress demanded immense sums of money, the expedient resorted to will be easily understood.

With few exceptions, perhaps, for a quarter of a century most museums became so exclusive that public admission was considered a hindrance or a nuisance. Even after attempts were made to give up this exclusiveness, something of it remained, and a natural consequence of this tendency was a sort of exclusiveness in the naturalists themselves, who stood aloof with their works

and collections for some time, till both were ready for the study and use of the public, just as an artist is not accessible till his work is accomplished.

The great impulse given to science by Cuvier was felt through the whole world, and every naturalist realized the necessity of a renewed and earnest study to enable him to follow the rapid progress of the master. The new way led directly to a comparative anatomy as basis for a comparative zoölogy. The admirable collections for this kind of study made and established in the Jardin des Plantes by Cuvier and his faithful associate, Laurillard, were at the time unrivaled, and show the immense amount of labor performed before the results could be published.

The aim of Cuvier was so expansive that even his masterpiece, the Règne Animal, was considered by him only as a tool necessary to be manufactured before he could work out the principles of natural history according to his ideas.

The result of this kind of revolution soon manifested itself in every museum, and the French ones under the eye of the master were far in advance. The new era developing the rights of man led directly to the necessity that everybody should be enabled to have his share in this advance of science. Museums were again thrown open to the public, and the peculiar taste for exhibition and show made the French museum, for more than a quarter of a century, the leading and most refined in the world; the other countries followed more or less slowly but steadily in their own way. It is a remarkable fact that even in the Jardin des Plantes, where the low, old-fashioned rooms were very soon overcrowded with objects, it was apparent that such a multitude of facts could be neither agreeable nor useful for public instruction. It was deemed advisable to prepare a separate collection, selected and arranged in a manner to be interesting to the public, which, being prepared according to French taste, was superior to all former ones. It is proper to mention here that just at this time, when Paris was the centre of science for the world, one of the most prominent of the army of ardent disciples of Cuvier was a young student from Neufchatel, Switzerland, — Louis Agassiz. The time of Cuvier is the date of the beginning of most of the large museums now in existence; some of them, indeed, were started before, but in a different and far inferior manner, so that few of the contents could be retained when the new start began which influenced so powerfully those of London, Vienna, Berlin, Copenhagen, Stockholm, Munich, and St. Petersburg.

It now became impossible for private collections to compete with the larger and steadily advancing museums, and the old custom which rich merchants had kept up for several centuries of accumulating collections began to disappear, and, to the detriment of science, was rarely renewed. Nevertheless, some of the old collections of this kind have lasted even to our times. Of private collections the museum of Sir Ashton Lever, afterwards, if I am not mistaken, united with the British Museum, was one of the most prominent, and some others known now only through printed catalogues were important.

The Ashmolean Museum, in Oxford, before it was transferred to the new rooms in 1861 was perhaps one of the most curious examples of the old style. Even in America, the East India museum in Salem, before the foundation of the Peabody Academy of Science, was a fair specimen of such collections of various objects of natural history, ethnological materials, and curiosities.

Private collections were now devoted to special classes or orders, according to the taste of the owner, and even often surpassed in their speciality larger museums. The impossibility of private students advancing natural history by means of large collections led quite naturally to associations and societies for this purpose, a considerable number of which were founded in nearly every country, so that science gained a large amount of facts, very prominent publications, and even more or less excellent collections. But soon most of them saw that their means were not adequate to their exertions. The collections suffered first, as it was not possible to maintain and preserve them in a scientific way. Later they grew to be a burden, and had to be given up more or less reluctantly, and the societies confined themselves to scientific work and publishing the results. There are a few exceptions where large means have been provided by patrons, and of these the Society of Natural History in Boston is the most prominent, and is unrivaled in its collection and manner of exhibition. Of course such societies have a task to accomplish which grows heavier every year. At any rate, science is much indebted to them for providing means for the publication of valuable matter which often would have been left unpublished without their generous help.

The public itself looked upon the ardent exertions of the naturalists with more curiosity than admiration, as the exclusiveness of science was the cause of a very moderate standard of general knowledge, till some of the most prominent workers found it

advisable to put the results of their investigations into a shape which could be understood by people not scientifically trained. The pride of the century, Alexander von Humboldt, led the long series of such publications, and the interest of the public, once awakened, exceeded all expectations, so that in later times the so-called popular literature of natural history equaled or even superseded the scientific publications. Of course every museum deemed it a duty to keep pace with this interest, and opened its doors to the public. At first, things went on to the satisfaction of both parties; but by and by a natural change took place. The aim to exhibit the collections in a way pleasing and satisfactory to the public taste necessitated work often beyond the power of the officers, and to the scientific detriment of the collections. The buildings proved to be mostly too small, or at least not fit to exhibit the objects in a suitable way, and in the new ones the principal claim on the architect was often to satisfy the taste of the public by giving a beautiful view of the specimens, the interests of science being secondary. An imposing hall, with splendid galleries, staircases, and large, high rooms, was the basis of a plan for a museum. The specimens themselves were to be arranged more or less artistically: birds and butterflies first, fishes and crabs being condemned to the corners.

The three principal conditions of a building intended for a museum, convenient rooms, light, and the exhibition of the objects, had to be balanced in another way; the exhibition, as well as the light, took the heaviest share; and the latter being the greatest and most injurious enemy to the preservation of objects of natural history, the disadvantage for science increased in such museums beyond all measure. The necessity of securing specimens against injury augmented the expenses considerably, especially when all objects should be exhibited. Nevertheless the aim of public instruction could not often be attained in a way to match the exertions. The larger the collection, the smaller its value for the instruction of the public. The reason is obvious. Anybody obliged to pass about a quarter of a mile before cases with only water-fowls or sparrows, or to look at twenty thousand species of beetles of the same family, becomes bewildered and loses the connection between the different forms, the very thing for which he wished to see the museum.

Such large collections, which would be the pride and the aim of the scientific naturalist, are like a complete dictionary to the linguist; but nobody, I believe, will undertake to read a dictionary

for pleasure or for general instruction. This somewhat hybrid tendency to satisfy at the same time science and the public proved to be detrimental to both these and the naturalist himself. Every country complained of the gradual conversion of scientific associations into popular audiences, with no scientific knowledge to speak of, and this had the usual effect even upon scientists.

The conclusion is very simple; the desire of advancing science is very different from that of advancing the knowledge of the non-scientific public, and both cannot be attended to at the same time and with the same means, without hindrance and injury to one or the other. The importance of the separation of these two has, during the last score of years, been more and more fully acknowledged. The plans of several museums recently built were appropriate to different purposes, either scientific ones or those adapted to public instruction, and beautiful specimens of both these patterns are in existence.

It was certainly strange and unfitting to ask a naturalist to study in the same room an elephant and a small worm, so that rooms suitable for the best observation of both seemed to be a necessity. The plan of scientific museums provides for the comparatively small number of large animals large rooms or halls, and a series of small connected rooms, so that the different classes and orders may be kept separate, thus allowing a thoroughly scientific arrangement of the objects, not to be altered for merely showy purposes. The creation of a scientific museum requires long and hard labor of generations of naturalists, and unless scientifically separated, the largest accumulation of objects of natural history forms only a sort of store-house. A museum cannot be bought at once with money, but must be developed by steady work. The largest and most advanced museums in the world have been arranged by three or even four succeeding generations of naturalists, and are still more or less remote from the achievement of their intended perfection. The only way to hasten the work is to buy scientifically prepared collections, but the chance to do this is rare, and the difference between the objects bought and those not yet worked up often creates an unpleasant discrepancy.

The expedient of sending out persons to collect the natural objects of a number of countries for museums seems quite natural, and indeed has been resorted to in many cases. The financial result was generally unsuccessful, and the objects more expensive than the highest market price. No doubt such expeditions fur-

ther and advance science to a degree not to be attained in any other way, and should therefore not be done away with. But a museum dependent for its subsistence upon certain and regular funds would be able to undertake them only rarely, and with the generous help of patrons, as is done so successfully in this country.

On the whole, a well-managed museum hardly needs these extraordinary and irregular exertions, which always retard the progress of the institution. It should not be forgotten that a museum has a great advantage over a private collection, as it is generally of no great consequence if it waits years for a favorable chance to obtain certain objects, whilst a private collection can wait only during the life-time of its possessor, or rather during his working years.

Indeed, the overwhelming number of objects obtained during the last thirty years by the steadily increasing trade with the whole world has filled every museum to overflowing, and thus retarded its progress. The scientific work is still entirely unable to keep pace with the collector. The conscientious worker in a museum suffers every day the torments of Tantalus, having before him innumerable and most interesting objects for the furtherance of science, and for excellent publications. He must therefore content himself with only putting them in the right places and on the right shelves, and has no time for scientific work if he would fulfill his duty. He is surely pardonable if he occasionally revolts, although he finds his recompense in the conviction that he is working not only for himself but for others, for the advancement of science and of culture.

The sudden and unlooked-for enlargement of the collections has another equally unexpected consequence, which has not yet been accounted for. In former times most of the specimens were dried, and natural science came to be merely a knowledge of dried skins and dried animals, and the last great zoölogist who knew nothing but the skins of animals died only thirty years ago. The enormous expense of preserving objects in alcohol became more and more embarrassing, and a large part of the income of every museum had to be expended every year for this purpose. It is easy to calculate the time when a museum will be obliged to stop its work, and even be unable to preserve the objects already in hand. Various other liquids have been tried with more or less success, and finally the fact that objects preserved in a different way were generally unfit for comparison determined collectors to return to the use of alcohol.

Natural history still consists principally in the knowledge of dead and preserved animals as seen in the museums. Eventually zoölogy became a museum zoölogy. Every worker knows the difficulty of using scientific works in comparing living or fresh specimens, though he has no difficulty at all with such as have undergone the regular museum process.

It would be unfair not to acknowledge the steps now taken by naturalists to overcome this still enormous difficulty, and the real progress already made; but nevertheless it is certainly a great advantage to science that in every museum the objects are preserved in the same way. It is therefore clearly necessary to find the easiest means of reducing the evaporation of this expensive fluid, and this attempt has been made in all European museums during the last ten years.

We have now traced the development of collections of natural history to the present time. The separation of collections to advance science from those designed to advance general knowledge will be doubtless a permanent one, and is to be considered as a sign of real progress, as a benefit to mankind. The collections designed to advance science will be archives of all that has been done in science. The better the facts of science are preserved, the better the archives will be. These collections will have only an indirect advantage for the public, just as a book is of no use before one is able to read.

The noblest aim to be fulfilled by these scientific collections is to prepare the way and show how museums intended to advance knowledge, namely, collections for public instruction, can be made and arranged so as to be best fitted for their purpose. I believe that this way will not be difficult to discover, if the purpose and the aim are clearly defined. As text-books must be adapted to the degree of knowledge of the student who is to peruse them, so must museums correspond to the average standard of knowledge in the public which visits them; and as in text-books this standard may be placed somewhat above the average knowledge, so collections should be formed which would necessitate the public to adapt itself to a higher standard — a thing mankind is always inclined to do.

It will be found impossible to arrange museums exactly fitted for every kind of knowledge. As a certain limit must be given to them, it may be best to have at least one so-called epitome-collection, in which every beginner should find, as in arithmetic, the easiest means for acquiring further knowledge. The adoption

of such a principle in the arrangement of museums would be equal to the different grades of text-books for different classes of students. Only the great amount of money needed to make so many different collections, and the still greater expense of maintaining them at the proper scientific standard, will prevent the arrangement of such manifold collections, though it would be the best way to educate the public. As science is to become simpler at every step in advance, and to lift higher and higher the mystical veil now so impenetrable to those without scientific knowledge, we have a right to hope that hereafter the way indicated above will be made less expensive and rendered possible of attainment. Hence everybody is called upon to hasten the progress of science, as the most effective means for the advance of general knowledge.

LUBBOCK'S OBSERVATIONS ON BEES AND ANTS.

THE second of Sir John Lubbock's series of Observations on Bees, Wasps, and Ants has recently been published in the *Journal of the Linnean Society*, and the following extracts may give our readers some idea of the interesting nature of his observations, which simply require a little time and patience, and could be tested and extended by one not an expert in systematic entomology or the anatomy of insects. It is surprising that there are not more observers of the habits of animals in this country, among young people. The last thing taught in our public schools is the habit of observation, the only path to reflection as well as independence in thinking.

Lubbock's earlier papers tended to show that while bees do not communicate information to one another, ants certainly have this power. Now our author publishes a series of facts, diaries of the doings of bees, which show, in his opinion, "that some bees, at any rate, do not communicate with their sisters, even if they find an untenanted comb full of honey, which to them would be a perfect Eldorado. This is the more remarkable because these bees began to work in the morning before the rest, and continued to do so even in weather which drove all the others into the shelter of the hive. That the strange bees which I have recorded should have found the honey is natural enough, because there were a good many bees about in the room."

The following fact is mentioned by F. Müller as seeming also to show a limited power of communicating facts on the part of

bees: "Once," he says,[1] "I assisted at a curious contest which took place between the queen and the worker bees in one of my hives, and which throws some light on the intellectual faculties of these animals. A set of forty-seven cells had been filled, eight on a nearly completed comb, thirty-five on the following, and four around the first cell of a new comb. When the queen had laid eggs in all the cells of the two older combs, she went several times round their circumference (as she always does, in order to ascertain whether she has not forgotten any cell), and then prepared to retreat into the lower part of the breeding-room. But as she had overlooked the four cells of the new comb, the workers ran impatiently from this part to the queen, pushing her, in an odd manner, with their heads, as they did also other workers they met with. In consequence, the queen began again to go around on the two older combs; but as she did not find any cell wanting an egg, she tried to descend, but everywhere she was pushed back by the workers. This contest lasted for a rather long while, till the queen escaped without having completed her work. Thus the workers knew how to advise the queen that something was as yet to be done, but they knew not how to show her *where* it had to be done."

I have already mentioned, with reference to the attachment which bees have been said to show for one another, that though I have repeatedly seen them lick a bee which had smeared herself in honey, I never observed them show the slightest attention to any of their comrades who had been drowned in water. Far, indeed, from having been able to discover any evidence of affection among them, they appear to be thoroughly callous and utterly indifferent to one another. As already mentioned, it was necessary for me occasionally to kill a bee; but I never found that the others took the slightest notice. Thus on the 11th of October I crushed a bee close to one which was feeding, — in fact, so close that their wings touched; yet the survivor took no notice whatever of the death of her sister, but went on feeding with every appearance of composure and enjoyment, just as if nothing had happened. When the pressure was removed, she remained by the side of the corpse without the slightest appearance of apprehension, sorrow, or recognition. It was, of course, impossible for her to understand my reason for killing her companion; yet neither did she feel the slightest emotion at her sister's death, nor did she show any alarm lest the same fate should befall her also. In a second case exactly the same occurred. Again, I have

[1] Nature, June 11, 1874.

several times, while a bee has been feeding, held a second bee by the leg close to her; the prisoner, of course, struggled to escape, and buzzed as loudly as she could; yet the selfish (?) eater took no notice whatever. So far, therefore, from being at all affectionate, I doubt whether bees are in the least fond of one another.

Their devotion to their queen is generally quoted as a most characteristic trait; yet it is of the most limited character. For instance, I was anxious to change my black queen for a Ligurian; and accordingly, on the 26th of October, Mr. Hunter was good enough to bring me a Ligurian queen. We removed the old queen, and we placed her with some workers in a box containing some comb. I was obliged to leave home on the following day; but when I returned on the 30th, I found that all the bees had deserted the poor queen, who seemed weak, helpless, and miserable. On the 31st the bees were coming to some honey at one of my windows, and I placed this poor queen close to them. In alighting, several of them even touched her; yet not one of her subjects took the slightest notice of her. The same queen, when afterwards placed in the hive, immediately attracted a number of bees.

That a bee can distinguish scents is certain. On the 5th of October I put a few drops of eau de Cologne in the entrance, and immediately a number (about fifteen) of bees came out to see what was the matter. Rose-water also had the same effect; and, as will be mentioned presently, in this manner I called the bees out several times; but after a few days they took hardly any notice of the scent. For instance, on the 17th of October I tried them with twenty drops of eau de Cologne, the same quantity of essence of violet, of lavender-water, of essence of musk, of essence of patchouli, and of spirits of wine; but they took no apparent notice of any of them.

I have also made some observations with the view of ascertaining whether the same bees act as sentinels. With this object, on the 5th of October I called out the bees by placing some eau de Cologne in the entrance, and marked the first three bees that came out. At five P. M. I called them out again; about twenty came, including the three marked ones. I marked three more.

October 6th. Called them out again. Out of the first twelve, five were marked ones. I marked three more.

October 7th. Called them out at 7.30 A. M., as before. Out of the first nine, seven were marked ones.

At 5.30 P. M., called them out again. Out of six, five were marked ones.

October 8th. Called them out at 7.15. Six came out, all marked ones.

October 9th. Called them out at 6.40. Out of the first ten, eight were marked ones.

Called them out at 11.30 A. M. Out of six, three were marked. I marked the other three.

Called them out at 1.30 P. M. Out of ten, six were marked.

Called them out at 4.30. Out of ten, seven were marked.

October 10th. Called them out at 6.05 A. M. Out of six, five were marked.

Shortly afterwards I did the same again, when out of eleven, seven were marked ones.

At 5.30 P. M., called them out again. Out of seven, five were marked.

October 11th. At 6.30 A. M., called them out again. Out of nine, seven were marked.

At five P. M., called them out again. Out of seven, five were marked.

After this day they took hardly any notice of the scents.

Thus in these nine experiments, out of the ninety-seven bees which came out first, no less than seventy-one were marked ones, though out of the whole number of bees in the hive there were only twelve marked for this purpose, and, indeed, even fewer in the earlier experiments. I ought, however, to add that I generally fed the bees when I called them out.

It is sometimes said that the bees of one hive all know one another, and immediately recognize and attack any intruder from another hive. At first sight this certainly implies a great deal of intelligence. It is, however, possible that the bees of particular hives have a particular smell. Thus Langstroth, in his interesting treatise on the Honey Bee, says, "Members of different colonies appear to recognize their hive companions by the sense of smell;" and I believe that if colonies are sprinkled with scented syrup, they may generally be safely mixed. Moreover, a bee returning to its own hive with a load of treasure is a very different creature from a hungry marauder; and it is said that a bee, if laden with honey, is allowed to enter any hive with impunity. Mr. Langstroth continues, "There is an air of roguery about a thieving bee which, to the expert, is as characteristic as are the motions of a pickpocket to a skillful policeman. Its sneaking

look and nervous, guilty agitation, once seen, can never be mistaken." It is at any rate natural that a bee which enters a wrong hive by accident should be much surprised and alarmed, and would thus probably betray herself.

On the whole, then, I do not attach much importance to their recognition of one another as an indication of intelligence.

I had made some observations also with the view of ascertaining whether the bees which collect honey also work in the hive and attend to the brood, or whether they devote themselves exclusively to one or other of these duties. My observations, however, were not conclusive; but some light has been thrown on the subject by Dzierzon, from which it would appear that for the first fortnight of a bee's life she attends exclusively to in-door duties, and only afterwards takes to the collection of honey and pollen. Dzierzon's statements have been confirmed by Dr. Dönhoff. On the 18th of April he introduced a Ligurian queen into a hive of black bees. The first Ligurian workers emerged on the 10th of May, and made their first appearance outside the hive on the 17th; but not until the 25th did any of the Ligurian workers appear on his feeding-troughs, which were constantly crowded with common bees, nor were any seen to visit the flowers. Repeated observations, says Dr. Dönhoff, "force me to conclude that during the first two weeks of the worker-bee's life the impulse for gathering honey and pollen does not exist, or at least is not developed, and that the development of this impulse proceeds slowly and gradually. At first the young bee will not even touch the honey presented to her; some days later she will simply taste it; and only after a lapse of time will she consume it eagerly. Two weeks elapse before she readily eats honey; and nearly three weeks pass before the *gathering* impulse is sufficiently developed to impel her to fly abroad and seek for honey and pollen among the flowers." [1]

In my first memoir I alluded to the difficulty which bees experience in finding their way about. In this respect they certainly differ considerably. Some of the bees which came out through the little postern door (already described) were able to find their way back after it had been shown to them a few times. Others were much more stupid; thus, one bee came out on the 9th, 11th, 12th, 14th, 15th, 16th, 17th, 18th, and 19th, and came to the honey; but though I repeatedly put her back through the postern, she was never able to find her way for herself.

[1] Hive and Honey Bee, Langstroth, p. 195.

I often found that if bees which were brought to honey did not return at once, still they would do so a day or two afterwards. For instance, on July 11, 1874, a hot, thundery day, and when the bees were much out of humor, I brought twelve bees to some honey; only one came back, and that one only once; but on the following day several of them returned.

My bees sometimes ceased work at times when I could not account for their doing so. October 19th was a beautiful, sunshiny, warm day. All the morning the bees were fully active. At 11.25 I brought one to the honey-comb, and she returned at the usual intervals for a couple of hours; but after that she came no more, nor were there any other bees at work. Yet the weather was lovely, and the hive is so placed as to catch the afternoon sun.

I have made a few observations to ascertain, if possible, whether the bees generally go to the same part of the hive. Thus, —

October 5th. I took a bee out of the hive, fed her, and marked her. She went back to the same part.

October 9th. At 7.15 I took out two bees, fed and marked them. They returned; but I could not see them in the same part of the hive. One, however, I found not far off.

At 9.30, brought out four bees, fed and marked them. One returned to the same part of the hive. I lost sight of the others.

Since their extreme eagerness for honey may be attributed rather to their anxiety for the common weal than to their desire for personal gratification, it cannot fairly be imputed as greediness; still the following scene, one which most of us have witnessed, is incompatible surely with much intelligence. "The sad fate of their unfortunate companions does not in the least deter others who approach the tempting lure from madly alighting on the bodies of the dying and the dead, to share the same miserable end. No one can understand the extent of their infatuation until he has seen a confectioner's shop assailed by myriads of hungry bees. I have seen thousands strained out from the syrup in which they had perished; thousands more alighting even upon the boiling sweets; the floor covered and windows darkened with bees, some crawling, others flying, and others still so completely besmeared as to be able neither to crawl nor fly — not one in ten able to carry home its ill-gotten spoils, and yet the air filled with new hosts of thoughtless comers." [1]

If, however, bees are to be credited with any moral feelings at

[1] Hive and Honey Bee, Langstroth, p. 277.

all, I fear the experience of all bee-keepers shows that they have no conscientious scruples about robbing their weaker brethren. "If the bees of a strong stock," says Langstroth, "once get a taste of forbidden sweets, they will seldom stop until they have tested the strength of every hive." And again, "Some bee-keepers question whether a bee that once learns to steal ever returns to honest courses." Siebold has mentioned similar facts in the case of wasps (*Polistes*).

M. Forel, in his excellent work, Les Fourmis de la Suisse, asserts that ants, when they first quit the pupal state, like the bees, devote themselves to household duties and the care of the young, not taking any part in the defense of the nest until a later period of life. He has repeated many of Huber's experiments. As regards the memory of ants, he convinced himself that they recognized their companions after a separation of four months; but he believes they would not do so for more than one season. In my previous memoir I have described the behavior of ants to companions from whom they had been separated for several months, and mentioned that I could not satisfy myself as to the lively manifestations of joy and satisfaction described by Huber as being shown under such circumstances. M. Forel, in the above-mentioned work, expresses his opinion that the signs which Huber regarded as marks of affection were in reality signs of distrust and fear, which, however, were soon removed.

Ants of different nests are generally enemies; but M. Forel assures us (page 262) that when they first quit the pupa-stage, ants do not distinguish friends from foes, though three or four days are sufficient to enable them to do so. It is to be regretted that he does not give the facts on which this interesting statement is based.

The behavior of ants to one another differs very much according as they are alone or supported by numerous companions. An ant which would run away in the first case will fight bravely in the second (page 249).

MM. Forel and Ebrard both assert that if an ant is a little ill, or slightly wounded, she is carefully tended by her companions; while, on the other hand, those which are dangerously ill or wounded are carried out of the nest to die. I have not met with any cases of this kind.

Again, some days I found no ants about on my window-sill as usual, although there seemed nothing in the weather to account for it.

I quote the following in order to show the steadiness with which ants work.

July 13th. At 6.20 A. M. I put an ant to some honey; at 6.40 she went, at 7.02 she returned, and at 7.08 went away again, but not to the nest; at 7.11 she returned, and at 7.15 went away again.

At 7.27 she came back.	7.40 went.	At 1.30 she came back; at 1.41 went.
7.49 "	8.05 "	1.51 " 2.06 "
8.14 "	8.19 "	after which I was unable to go on watch-
8.31 "	8.39 "	ing.
8.43 "	8.47 "	Another ant the same morning came to
8.55 "	9 "	honey at 6.55 A. M., at 7.04 went away.
9.08 "	9.10 "	Returned 7.10 " 7.14 "
9.17 "	9.26 "	" 7.34 " 7.36 "
9.34 "	9.40 "	" 7.45 " 7.50 "
9.49 "	10 "	" 8.02 " 8.07 "
10.11 "	10.20 "	" 8.17 " 8.22 "
10.27 "	10.36 "	" 8.31 " 8.36 "
10.44 "	10.52 "	" 8.44 " 8.58 "
12.52 "	12.54 "	" 8.59 " 9 "
1.03 "	1.20 "	

after which she came back no more. During this time fifteen others had come to the honey.

That ants have a certain power of communication has been proved by Huber and other observers. Several striking cases are mentioned by M. Forel. For instance (*op. cit.*, page 297), an army of Amazon ants, on an expedition in search of slaves, attacked a nest of *Formica rufibarbis*. In a few seconds (quelques secondes) the dome of the nest was covered with *F. rufibarbis*, which rushed out to defend their house.

On another occasion he placed a number of *Tetramorium cæspitum* about four inches from a colony of *Pheidole pallidula*. "En un clin d'œil," he says (page 384), "l'alarme fut répandue, et des centaines de *Pheidole* se jetèrent au devant de l'ennemi."

Again, he (page 349) placed some earth containing a number of *Tetramorium* about four inches from a nest of *Strongylognathus Huberi*. Several combats took place; but after the lapse of a few minutes (quelques minutes) a whole army of *S. Huberi* emerged and attacked the intruders.

On another occasion, some Amazon ants (page 301) were searching in vain for a nest of *Formica rufibarbis*. After a while some of them found the nest. "Immediately" (aussitôt), he says, "a signal was given, the Amazons rushed in the right direction, and pillaged the nest in spite of its inhabitants." This is a surprising statement. If it is to be taken literally, the communication cannot have been made by the antennæ; the signal can

hardly have been a visible one; are we then to imagine a sound or smell to have been made use of which our auditory and olfactory nerves are incapable of perceiving? or have ants some sense which we do not possess?

It would even appear, from M. Forel's statements, that in some cases one species comprehends the signs of another. This is, of course, the case when different species live in association; but I am now speaking of hostile species. *Formica sanguinea*, he assures us, understand the signals of *F. pratensis*. "Elles savent," he says (page 359), "toujours saisir l'instant où les *pratensis* se communiquent le signal de la déroute, et elles savent s'apprendre cette découverte les unes aux autres avec une rapidité incroyable. Au moment même où l'on voit les *pratensis* se jeter les unes contre les autres en se frappant de quelques coups rapides, puis cesser toute résistance et s'enfuir en masse, on voit aussi les *sanguinea* se jeter tout-à-coup au milieu d'elles sans la plus petite retenue, mordant à droite et à gauche comme des *Polyergus*, et arrachant les cocons de toutes les *pratensis* qui en portent."

He is of opinion (page 364) that the different species differ much in their power of communicating with one another. Thus, though *Polyergus rufescens* is smaller than *F. sanguinea*, it is generally victorious, because the ants of this species understand one another more quickly than those of *F. sanguinea*.

It appeared to me that the following experiment might throw some light on the power of communication possessed by ants, namely, to place several small quantities of honey in similar situations, then to bring an ant to one of them, and subsequently to register the number of ants visiting each of the parcels of honey, of course imprisoning for the time every ant which found her way to the honey except the first. If, then, many more came to the honey which had been shown to the first ant than to the other parcels, this would be in favor of their possessing the power of communicating facts to one another, though it might be said they came by scent. Accordingly, on the 13th of July, at three P. M., I took a piece of cork about eight inches long and four inches wide, and stuck into it seventeen pins, on three of which I put pieces of card with a little honey. Up to 5.15 no ant had been up any of these pins. I then put an ant to the honey on one of the bits of card. She seemed to enjoy it, and fed for about five minutes, when she went away. At 5.30 she returned, but went up six pins which had no honey on them. I then put her on to the card.

In the mean time twelve other ants had been up wrong pins and two up to the honey; these I imprisoned for the afternoon. At 5.46 my ant went away. From that time to six o'clock, seven ants came, but not the first. One of the seven went up a wrong pin, but seemed surprised, came down, and immediately went up the right one. The other six went straight up the right pin to the honey. Up to seven o'clock twelve more ants went up pins — eight right, and four wrong. At seven, two more went wrong. Then my first ant returned, bringing three friends with her; and they all went straight to the honey. At 7.11 she went; on her way to the nest she met and spoke to two ants, both of which then came straight to the right pin and up it to the honey. Up to 7.20 seven more ants came and climbed up pins — six right, and one wrong. At 7.22 my first ant came back with five friends; at 7.30 she went away again, returning at 7.45 with no less than twenty companions. During this experiment I imprisoned every ant that found her way up to the honey. Thus, while there were seventeen pins, and consequently sixteen chances to one, yet between 5.45 and 7.45 twenty-seven ants came, not counting those which were brought by the original ant; and out of these twenty-seven, nineteen went up the right pin. Again, on the 15th of July, at 2.30, I put out the same piece of cork with ten pins, each with a piece of card and one with honey. At 4.40 I put an ant to the honey; she fed comfortably, and went away at 4.44.

At 4.45 she returned, at 5.05 went away. At 6.13 she returned; again at 6.25 and
" 5.40 " 5.55 " 6.59.

There were a good many other ants about, which, up to this time, went up the pins indiscriminately.

At 7.15 an ant came and went up the right pin, and another at 7.18. At 7.26 the first ant came back with a friend, and both went up the right pin. At 7.28 another came straight to the honey.

At 7.30 one went up a wrong pin.
" 7.31 one came to the right pin.
" 7.36 one came to the right pin with the first ant.
At 7.39 one came to the right pin.
" 7.40 " "
" 7.41 " "
" 7.43 " "
" 7.45 " "
" 7.46 " "
" " " wrong pin.
" " " "
" 7.47 two " "
At 7.48 one came to the right pin.
" " the first ant came back.
" 7.49 another came to the right pin.
" 7.50 " " wrong "
" 7.51 " " right "
" " three " wrong "
" 7.52 one " right "
" 7.55 " " wrong "
" " " " right "
" 7.57 " " wrong "
" 7.58 " " right "
" 7.59 " " wrong "

Thus after seven o'clock twenty-nine ants came; and though there were ten pins, seventeen of them went straight to the right pin.

On the 16th of July I did the same again. At 6.25 I put an ant to the honey; at 6.47 she went.

At 6.49 an ant came to the right pin.
" 6.50 another " "
" 6.55 " " "
" 6.56 " came to the wrong pin, and then to the right one.
At 6.58 another came to the right pin.
" 7 " " "

At 7.05 the first ant came back, and remained at the honey till 7.11.
At 7.05 another came to the right pin; but she was with the first.
At 7.06 another ant came to the right pin.
" 7.06 " "
" 7.12 " "
" 7.13 " "

These two ants were met by the first one, which crossed antennæ with them, when they came straight to the honey.

At 7.14 another ant came straight to the honey.
At 7.21 the first ant returned; at 7.26 she left.
At 7.24 another ant came, but went to a wrong pin, and then went on to the right one.
At 7.24 an ant came to wrong pin.
" " " " "
" " " " "
" 7.34 " " "
" 7.35 " " "
" 7.38 the first came back, at 7.45 went away again.

At 7.42 an ant went to a wrong pin.
" 7.47 " " "
" 7.48 " " "
" 7.49 " " "
" 7.52 " " the right pin.
" 7.55 the first ant returned, and at 7.56 went away again.
" 7.57 an ant went to wrong pin.
" 7.58 " right "
" 8 " wrong "
" 8 " right "
" 8.01 wrong "

After this, for an hour, no more ants came. On this occasion, therefore, while there were ten pins, out of thirty ants, sixteen came to the right one, while fourteen went to one or other of the nine wrong ones.

July 18th. I put out the boards as before at four o'clock. Up to 4.25 no ant came. I then put one (No. 1) to the honey; she fed for a few minutes, and went away at 4.31.

At 4.35 she came back with four friends, and went nearly straight to the honey. At 4.42 she went away, but came back almost directly, fed, and went away again.

At 4.57 she returned, and at 5.08 went away again.
At 4.45 an ant came to wrong pin.
" 4.47 " "
" 4.49 " "
" 4.50 " right pin.
" 4.52 " "
" 4.55 " wrong pin.
" 4.56 " right pin. This ant (No. 2) I allowed to return to the nest, which she did at 5.23.

At 5.06 an ant came to the right pin.
" 5.11 " wrong pin.
" 5.12 " right pin.
I changed the pin.
At 5.16 an ant came to the pin which I had put in the same place.
At 5.16 an ant came to the right pin.
" 5.19 " "
" 5.20 two ants " with No. 2.

At 5.20 ant No. 1 came to right pin and went at 5.25.
At 5.25 anant came to right pin; this ant had been spoken to by No. 2.
At 5,26 another ant came to right pin.
" 5 35 " "
" 5.37 " "
" 5.40 " "
" 5.41 ant No. 1 " and went at 5.49.
At 5.45 another ant "
" 5.50 " "
At 5.51 ant No. 1 came back, and at 5.54 went.
At 5.58 two ants came to the right pin.
" 5.59 another ant " "
" " " " wrong pin.
I changed the pin again.
At 6.49 an ant came to the pin which I had put in the same place.
At 7.01 another ant came to the right pin.
" 7.20 " "
" 7.33 " "
" 7.46 ant No. 1 returned, 7.55 went.

Thus during this time, from 4.50 until 7.50, twenty-nine ants came, twenty-six went to the right pin, while only three went up any of the nine wrong ones. Moreover, out of these twenty-six, only four were distinctly brought by the two ants which I had shown the honey.

On the 19th I tried a similar experiment. The marked ants frequently brought friends with them; but, without counting these, from 3.20 to eight o'clock, out of forty-five ants, twenty-nine went up the right pin, while sixteen went up the nine wrong ones.

Thus on

July 13th, of 27, 19 went right, 8 wrong.
" 15th, " 29, 17 " 12 "
" 16th, " 30, 16 " 14 "
July 18th, of 26, 23 went right, 3 wrong.
" 19th, " 45, 29 " 16 "

Or, adding them all together, while there were ten pins at least, out of one hundred and fifty-six ants one hundred and three came up the right pin, and only fifty-three up the others.

It certainly appeared to me that some of the ants were much cleverer in finding their way to the honey than others; several ants which I put on honey came back to nearly the same place, and yet did not seem able to find the exact spot.

Again, some appeared to communicate more freely with their friends than others; and I have met with cases which show that some ants certainly do not, under such circumstances, summon others to their assistance. From this point of view the following observations may be compared with those already recorded. On the 1st of August an ant came to the honey at 4.20 and went away a few minutes afterwards.

At 4.36	returned,	at 4.41	went away.	At 6.21	returned,	at 6.31	went away.
" 4.52	"	4.58	"	" 6.39	"	6.43	"
" 5.11	"	5.15	"	" 6.55	"	6.59	"
" 5.30	"	5.35	"	" 7.30	"	7.36	"
" 6.05	"	6.10	"	" 7.49	"	7.54	"

Yet during all this time she brought no friend with her.

The following additional observations were made after the reading of the paper, at the dates severally mentioned below.

Thus on January 3d I placed some larvæ in three small porcelain saucers in a box seven inches square attached to one of my frame nests. The saucers were in a row, six inches from the entrance to the frame and one and a half inch apart from one another.

At 1.10 an ant came to the larvæ in the cup which I will call No. 1, took a larva, and returned to the nest.

At 1.24 she returned and took another.

" 1.45 " "

" 2.10 she went to the farther saucer, No. 3. I took her up and put her to No. 1. She took a larva and returned.

At 2.24 she returned to cup No. 3. As there were only two larvæ in this cup, I left her alone. She took one and returned.

At 2.31 she returned to cup No. 3 and took the last larva.

At 2.40 she came back to cup No. 3 and searched diligently, went away and wandered about for two minutes, then returned for another look, and at length at 2.50 went to cup No. 1 and took a larva.

At 3 came to cup 1 and took a larva.

" 3.07 " "

" 3.15 " "

first, however, going and examining cup 3 again.

At 3.18 came to cup 3, then went to cup 2 and took a larva.

At 3.30 came to cup 3, then went to cup 2 and took a larva.

At 3.43 came to cup 3, then went to cup 2 and took a larva.

At 3.53 came to cup 3, but did not climb up it, then went to cup 2 and took a larva, which she either dropped or handed over to another ant; for without returning to the nest, at 3.55 she returned to the empty cup, and then to cup 2, where she took the last larva, so that two cups are now empty.

At 4.03 she came to cup 3, then to cup 2, and lastly to cup 1, when she took a larva.

At 4.15 came to cup 1 and took a larva.

" 4.22 " "

" 4.38 " "

" 5 came to cup 3, then to cup 2, and lastly to cup 1, when she took a larva.

At 5.19 came to cup 1 and took a larva.

" 5.50 came to cup 2 and then to cup 1 and took a larva.

At 6.20 came to cup 1 and took the last larva.

I now put about eighty larvæ in cup 3.

It is remarkable that during all this time she did not come straight to the cups, but took a roundabout and apparently irresolute course.

At 7.04 she came to cup 1 and then to cup 3, and then home.

There were at least a dozen ants exploring in the box; but she did not send any of them to the larvæ.

At 7.30 she returned to cup 3 and took a larva.

I now left off watching for an hour. On my return

At 8.30 she was just carrying off a larva.

At 8.40 she came back to cup 3 and took a larva.

At 8.55 she came to cup 1, then to cup 3 and took a larva.

At 9.12 she came to cup 1, then to cup 3 and took a larva.

At 9.30 she came to cup 3, then to cup 3 and took a larva.

At 9.52 she came to cup 3, then to cup 3 and took a larva.

At 10.14 she came to cup 1, then to cup 3 and took a larva.

At 10.26 she went and examined cup 2, then to cup 3 and took a larva.

At 10.45 she came to cup 3, and I went to bed. At seven o'clock the next morning the larvæ were all removed. In watching this ant I was much struck by the difficulty she seemed to experience in finding her way. She wandered about at times most irresolutely, and, instead of coming straight across from the door of the frame to the cups, kept along the side of the box; so that in coming to cup 3 she went twice as far as she need have done. Again, it is remarkable that she should have kept on visiting the empty cups time after time. I watched for this ant carefully on the following day; but she did not come out at all.

During the time she was under observation, from 1 till 10.45, though there were always ants roaming about, few climbed up the walls of the cups. Five found their way into the (empty) cup 1 and one only to cup 3. It is clear, therefore, that the ant under observation did not communicate her discovery of larvæ to her friends.

EXPLORATIONS IN COLORADO UNDER PROFESSOR HAYDEN IN 1875.

THE United States Geological and Geographical Survey of the Territories, under the direction of Professor Hayden, during the season of 1875, continued the work of the two previous seasons in Colorado, completing the southern and southwestern portions, including a belt fifteen miles in width of Northern New Mexico and Eastern Utah.

The entire force was divided into seven parties. The district surveyed by the first party, under A. D. Wilson, embraced an area of 12,400 square miles. It contains the foot-hills sloping eastward from the Front Range, the southern continuation of the Saugre de Christo Range, the southern end of the San Luis Valley, the extension of the La Plata Mountains, and the lower country of the Rio San Juan and its tributaries. A small portion of the sedimentary eastern foot-hills was first surveyed, and the work was then carried westward to the mountainous vicinity of the upper Rio Grande. Instead of forming a well-defined, sharply-limited range, the mountains south of the Rio Grande are formed by a high plateau with numerous isolated peaks. Both the plateau and the peaks mentioned are volcanic, showing the characteristic regularity of flows prevalent there. From the position of volcanic beds composing the higher peaks it may be inferred that at one time the summit of the plateau extended to a consid-

erably higher altitude than at present. Towards the southwest it drops off suddenly into the lower country containing Rios Piedra and Pinos. Where the plateau ends, volcanic and sedimentary beds of Cretaceous age appear, extending from the Rio Animas eastward to the border of the district. Above the Cretaceous beds Nos. 2 and 3 is a series of shales and sandstones about three thousand feet in thickness, and containing coal at a number of points, of unknown geological age, though the series were thought to be possibly parallel with the Trinidad coal-bearing strata, and not of Cretaceous age.

The work was continued to the extension of the La Plata Mountains, among which evidences of former glaciers were found. In this region also there are evidences of the former existence of two very large lakes at the close of the volcanic activity there. The work was then connected to the north and northeast with that of 1874, and therewith finished.

The southwestern division, under the direction of W. H. Holmes as geologist, worked over an area of about sixty-five hundred square miles. The section of stratified rocks exposed extends from the lignitic series to the Carboniferous, including about two thousand feet of the former, and slight exposures merely of the latter. The heaviest seam of coal examined in the lignitic beds is twenty-one feet in thickness. In the Cretaceous beds fossils occurred in ten distinct horizons, which Mr. Holmes expects to be able to identify with corresponding ones on the Atlantic slope. The section obtained is the most complete and satisfactory made in Colorado up to this time.

The prehistoric remains in the cañons and lowlands of the southwest are of great interest. Many cliff houses built in extraordinary situations, and still in a fine state of preservation, were examined. A good collection of pottery, stone implements, — the latter including arrow-heads, axes, and ear-ornaments, — some pieces of ropes, fragments of matting, water-jars, corn and beans, and other articles were exhumed from the *débris* of a house. Many graves were found, and a number of skulls and skeletons that may fairly be attributed to the prehistoric inhabitants were added to the collection.

The western or Grand River division was under the charge of Henry Gannett, topographer, with A. C. Peale as geologist. The region surveyed embraces the country drained by the Uncompahgre and Dolores rivers and their branches, and the work extended about thirty miles into Utah, the total area surveyed

being about six thousand square miles. The geology of this district is comparatively simple, there being no great uplifts, nor many local disturbances. The sedimentary beds are all included under the Carboniferous, Red beds (Triassic?), Jurassic, and Cretaceous series. On August 15th, the work was brought suddenly to a close by the Indians.

The work of the fourth division, directed by G. R. Bechler, extended over a large area, situated from the foot-hills of the Rocky Mountains to the Upper Arkansas and Eagle rivers, and from a point six miles south of Pike's Peak to within fifteen miles of Long's Peak, including the great mining industries of Colorado.

The party under Mr. Gardner had made but little progress when it was prevented from doing further work by the Indians. One of the stations occupied was very important, namely, the Sierra la Sal Mountain, which enabled Mr. Gardner to secure an excellent set of observations, thus extending the triangulation far into Utah, and connecting the eastern work of the survey with the great Colorado River of the West.

The trip of Mr. Jackson, the photographer of the expedition, to the southwestern portion of Colorado renewed the work of 1874 on the ancient ruins north of the present Moquis Pueblos. Interesting archæological discoveries in the upper San Juan Mesa Verdé and La Plate regions were made by Mr. W. H. Holmes, in addition to his geological work. The ruins occurred only in those cañons which had alluvial bottoms. A strip of bottom land only fifty yards in width at the bottom of the deep cañons would yield maize enough to subsist quite a town. The supposition that they belonged to an agricultural people is strengthened by the fact that in the vicinity of any group of ruins there are also a number of little "cubby-holes," too small for habitations, but very evidently intended for "caches" or granaries, and the large towns contain small apartments that must have been designed for the same use. In one place where grass, cedar, and artemisia flourish, and there is most excellent grazing land, these people must have had herds of sheep or goats which they brought up here to graze during the winter, just as the Ute and Navajos do at the present time; and the towers so frequent in this region were probably built as places of refuge or residence for the herders. Upon the faces of rock near one of these ruins is an inscription chipped in with a sharp-pointed instrument, and covering some sixty square feet of surface. Figures of goats, lizards, and hu-

man forms abound, with many hieroglyphical signs. At other points adobe houses of great extent were discovered. One town, running along the face of a perpendicular bluff for three hundred yards, contained seventy-five rooms, with granaries and cisterns. In the centre of the mass was a well-preserved circular apartment, a little below the general level of the others, which was probably an *estrefa*. The goat corrals were inside, between the houses and the bluff. In another ruined town, consisting of houses scattered up and down the De Chelly and Bonito rivers, were great reservoirs in which was found abundant and excellent water.

A week was spent by Mr. Jackson at the Moquis towns, where he obtained photographs of the houses and the inhabitants. The comparison between the work of the prehistoric town-builders and the Moquis was very much in favor of the former, the highest degree of perfection being exhibited in the cliff houses of the Rio Mancos (described in the January NATURALIST), where some of the houses were marvels of finish and durability, while in traveling to the present homes of the Moquis there was found to be a gradual merging of the ancient into the modern style, from the neatly-cut rock and correct angles of the prehistoric race to the comparatively crude buildings now made by the Moquis. Other ruins in different cañons were visited, the most extensive of which were in the cañon and valley of the Montezuma. Here the bottom of the cañons once supported a very thickly settled community. There is in one lateral cañon an almost continuous series of ruins for a distance of twenty-five miles. Throughout the lateral cañons every available defensive point has been utilized, and is now covered with the remains of heavy walls and large blocks of houses.

Another singular feature was the number of holes cut into the perpendicular lower wall of the cañon for the purpose of ascending the rock, holes just large enough to give a hand and foot hold, and leading either to some walled-up cave or to a building erected above. Some of these steps ascended the nearly perpendicular face of the rock for one hundred and fifty or two hundred feet.

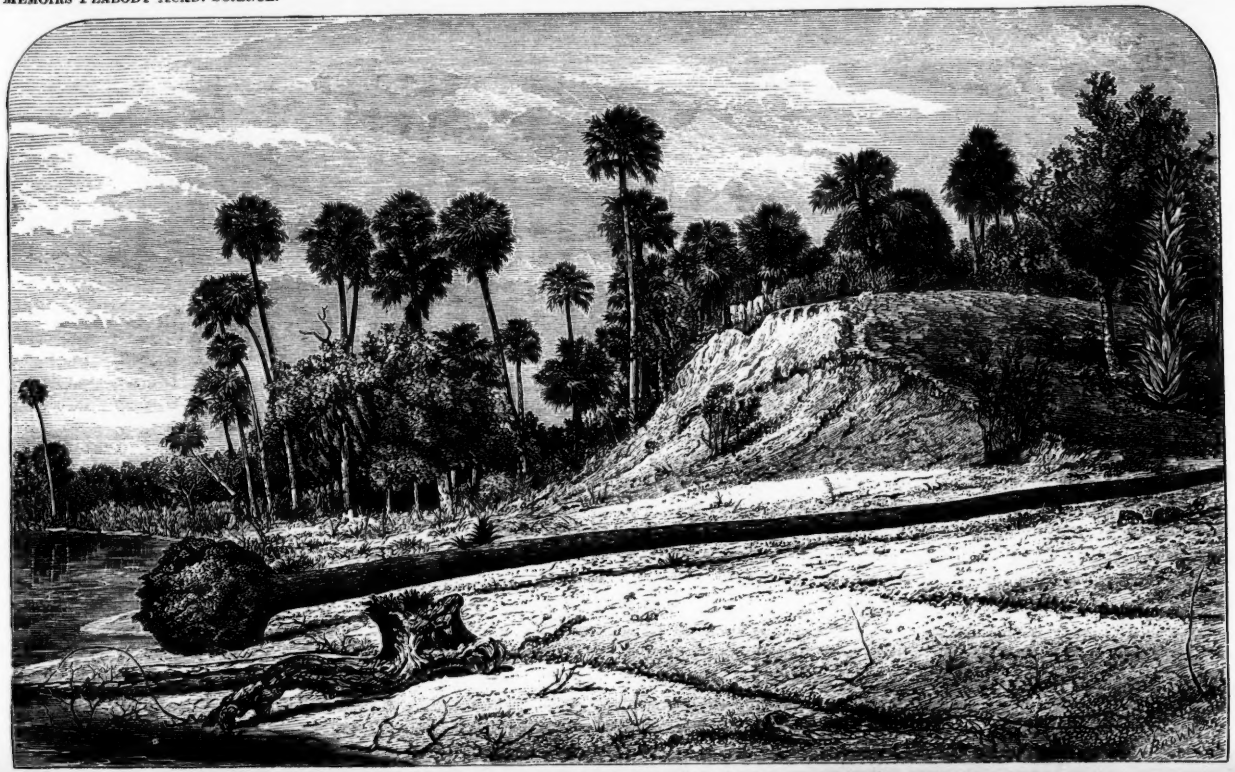
The results of this trip were the collection of a large number of utensils, both modern and ancient, stone arrow and spear points, knives and axes, with photographs especially illustrative of the most important ruins, and numerous sketches of everything of note, which will be brought out in detail in the regular publications of the survey.

During the summer, Mr. P. R. Uhler and Dr. A. S. Packard, Jr., were temporarily attached to the survey, and made collections of insects in Colorado. Dr. Packard investigated the ravages of the destructive grasshopper and other injurious insects of Colorado and Utah, with a view to the preparation of a report on the injurious insects of the Territories. He also discovered a new cave-fauna on the shores of Great Salt Lake, and investigated the Alpine insects of the Rocky Mountains.

RECENT LITERATURE.

WYMAN'S FRESH-WATER SHELL-MOUNDS OF THE ST. JOHN'S RIVER, FLORIDA.[1] — This very valuable contribution to our knowledge of the archæology of North America is modestly asserted by its lamented author to be "a record of what he has observed and a contribution to the knowledge of these ancient relics of a race which has long since passed away." It certainly is all this and more, although "still very incomplete," — a fact which goes far to show how wide a field for exploration and study is open to those devoted to archæological pursuits. The memoir opens with an admirably clear sketch of the characteristic features of the St. John's River, followed by a general description of the mounds, forty-eight in number, the majority of which are found between Lake George and Lake Harney. These shell-mounds, built up exclusively of fresh-water species, are peculiar, in being formed mainly by accumulations of Ampullarias and Paludinas, with a small percentage of mussel shells (Unios), as elsewhere these heaps are entirely formed of Unios, the other shells being either very scantily represented or altogether absent. Those here described "are in almost every case built on the banks of the river, resting either on one of the ridges of sand and river mud, ... or on land slightly raised." The accompanying plate (I.), forming the frontispiece to the memoir, illustrates the shell-mound at Old Enterprise. "From the presence of fire-places, ashes, calcined shells, charcoal, and implements, together with the bones of edible animals and occasionally those of man, found at various depths from top to bottom, and the absence of everything which might have been made by the white man, it seems certain that these mounds were the accumulations by and the dwelling-places of the earliest . . . . inhabitants, during the successive stages of their formation." As bearing upon the question of the antiquity of these mounds and their various contents of human origin, Professor Wyman remarks "that the building of the

[1] *Fresh-Water Shell-Mounds of the St. John's River, Florida.* By JEFFRIES WYMAN. Memoirs of the Peabody Academy of Science. Volume I. Number 4. Salem, Mass.: Published by the Academy. December, 1875. Royal 8vo, pp. 94. With a map and nine plates.



SHELL MOUND AT OLD ENTERPRISE. See p. 19.
WYMAN'S Memoir on the Fresh Water Shell Mounds of Florida.

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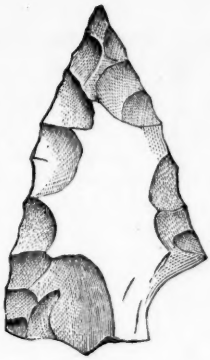

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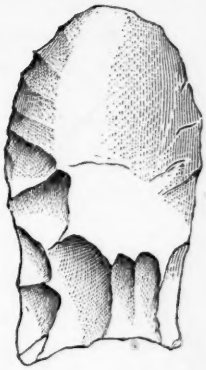

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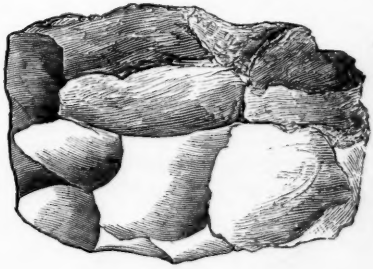

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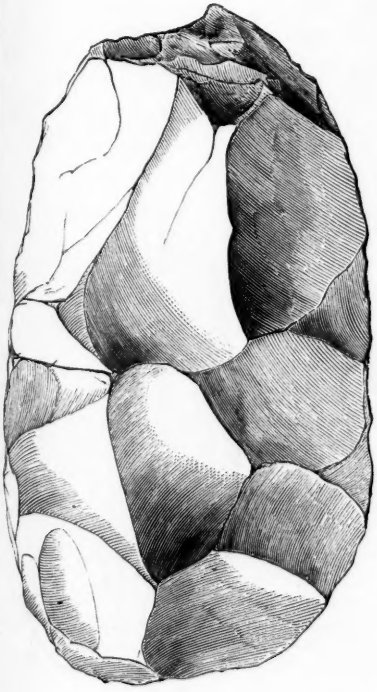

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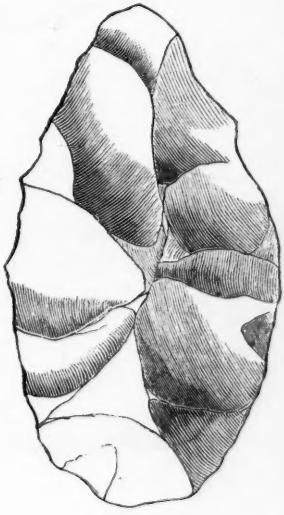

IMPLEMENTS OF STONE.

WYMAN'S Memoir on the Fresh Water Shell Mounds of Florida.

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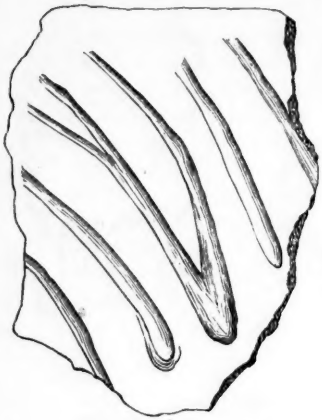

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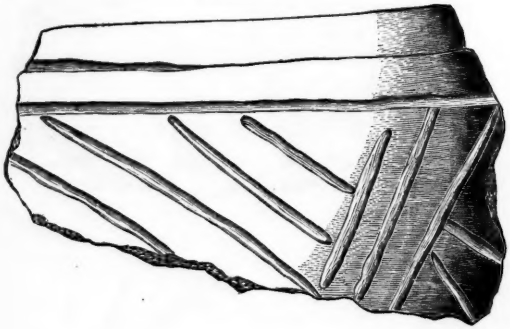

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POTTERY.

WYMAN'S Memoir on the Fresh Water Shell Mounds of Florida.

mounds extended through very long periods of time and were the result of very slow accumulation, or that the shells existed formerly in much greater quantities than now." Granting the probability of the latter supposition, the former seems much the more reasonable, and every fact discovered with reference to these mounds strengthens the probability, if we must so limit it, of the great age of these traces of a perished race. It is a curious fact that stone implements "were seldom met with in making excavations in the shell-mounds," inasmuch as we associate them with all early traces of human occupancy of any locality; but some few specimens were met with, and we recognize them to be such paleolithic forms as characterize the French bone caves (see Reliquiæ Aquitanicæ) and even those of an earlier date, since some are mentioned by the author as "resembling somewhat the celts of the St. Acheul pattern." The figures on Plate II., especially 1, 2, and 7, are also identical in form with the rude implements from the river gravels of the Delaware Valley (New Jersey), as comparison with specimens in the Cambridge museum will show. Here again we have an undoubted indication of the antiquity of the shell-mounds, and of their pre-Indian origin. Of the pottery it is remarked that fragments "exist in the later but not in the oldest mounds." This would indicate an acquirement of the knowledge of utilizing clay for making cooking-vessels while the mounds were in course of construction, or accumulation, and certainly the specimens from the mounds figured Plate V., figs. 3, 4, 5, and 6, are of the very rudest description, and less elaborate in ornamentation than much of the ware made by the Indians of the more northern and western States. Professor Wyman remarks that "a comparison of the pottery from the shell-heaps of the St. John's with that from other parts of Florida shows the important fact that they have but little similarity."

Besides descriptions of stone implements and those of bone and of shell, admirable chapters on pottery, human remains, traces of cannibalism, flattened tibiæ, and allied subjects, go to make up the contents of this important memoir. We have not space to allude to these in detail. Certainly no student of American archæology can do without the work, if he wishes to be well informed in this branch of the science.

MARSCHALL'S NOMENCLATOR ZOÖLOGICUS.[1] — The Zoölogical and Botanical Society of Vienna published in 1873 a Nomenclator Zoölogicus, prepared by Count Marschall, and intended to serve as a supplement to the well-known work of Agassiz. Not having been issued by a regular publishing house, the volume is less known than it would otherwise be. It purports to include all names of genera proposed for animals between 1846 and 1868, besides a few which were overlooked in the work

[1] *Nomenclator Zoölogicus:* continens nomina systematica generum animalium tam viventium quam fossilium, secundum ordinem alphabeticum disposita sub auspiciis et sumptibus C. R. Societatis Zoölogico-Botanicæ, conscriptus a comite AUGUSTO DE MARSCHALL. 8vo, pp. vi. 482. Vindobonæ. 1873.

of Agassiz. It is not, however, based upon the comprehensive plan which renders the earlier work so valuable, and is far inferior to it, not only in plan but in execution. As far as we have noticed, all names of groups higher than genera have been omitted; the value gained by their introduction would have far more than compensated for the slight additional labor required. To have added the derivations, as Agassiz did, would have so greatly augmented the labor of the compiler, besides increasing the cost of the work, that we can scarcely blame the omission, valuable as they would have been. What we deem, however, one of the prime defects of the work is that the names are not grouped in a single series, but are scattered under twenty-one distinct headings (representing as many groups of the animal kingdom), and no general index is furnished; one of the most frequent uses to which works of this nature are put is in searching whether a name which it is proposed to adopt is already in use in zoölogy; but for this, one must now look through twenty-one different lists. When we add that the work is full of misprints, has many names out of the intended alphabetical order, and is certainly by no means complete,[1] we are obliged to confess that a most useful intention has been spoiled in the accomplishment.

Hentz's Spiders of the United States.[2] — Besides its regular publications of Memoirs and Proceedings, the Boston Society of Natural History publish a series of Occasional Papers. The first of these was a collection and reprint in elegant style of the miscellaneous papers of the late Dr. T. W. Harris. A more useful work is the present reprint of the papers on our spiders, by Mr. Hentz. In its present form it will be the starting-point for future studies on this subject, and prove exceedingly useful from the large number of excellent figures, which represent however, species chiefly from the Southern States. The work has passed through careful editorial hands, and the drawings and notes by Mr. Emerton add not a little to the usefulness and value of the work. A biographical sketch is given by Mr. Burgess.

Morse's First Book of Zoölogy.[3] — The fact that a second edition of this attractive little book has so soon appeared is good evidence of its entire fitness as an elementary book of zoölogy. The few typographical errors which occurred in the first edition have been corrected; otherwise the book is the same, and to our mind in its present form unexception-

[1] As a single instance we may cite the entire absence of the numerous genera proposed by Fieber in Lotos, during 1854. This is the more remarkable as Fieber's papers were noticed at the time in a literary review published in Count Marschall's own country, the Bericht d. Oesterreich. Literatur.

[2] *The Spiders of the United States.* A Collection of the Arachnological Writings of Nicholas Marcellus Hentz, M. D. Edited by Edward Burgess, with Notes and Descriptions by James H. Emerton. Occasional Papers of the Boston Society of Natural History. II. Boston. 1875. 8vo, pp. 117. With 21 plates. Cloth, $3.50; paper, $3.00.

[3] *First Book of Zoölogy.* By Edward S. Morse, Ph. D., etc. New York: D. Appleton & Co. Second Edition. 12mo, pp. 190. 1876. With many wood-cuts. $1.25.

able as a text-book for boys and girls. We hope to see it introduced into every school in the country, for sooner or later zoölogy will have to be taught in all our common schools, at least so much of it as to cause children to collect and observe the common animals they meet with in their daily walks. An excellent feature of this book is that the child is led to examine the object and compare it with others, and is then stimulated to see how it acts, thus unconsciously getting some glimpses at least of the principles of morphology and physiology. The objects are called by their common names. The author has had the good sense to omit the scientific names, thus rendering the book vastly more attractive and useful. Many readers are anxious to first learn the Latin names, and are too often content to stop here. The scientific name is the thing of least importance. The author well illustrates, in the preface, the difficulty and mental confusion resulting from the present state of zoölogical nomenclature, the bane or necessary evil of the study of biology.

The Movements and Habits of Climbing Plants.[1] — We wish to refer our readers to a review of this book, and of Mr. Darwin's treatise on Insectivorous Plants, in recent numbers of the *Nation*. Our readers will recognize in the review the thorough analysis and clear statement which characterize Professor Gray's criticisms. It may be well to add to the review a single statement which is based on the opening sentences of Climbing Plants; namely, that Mr. Darwin had his attention first called to the subject several years ago, by a short paper by Professor Gray on the movement of certain tendrils.

Recent Books and Pamphlets. — Natural History and Antiquities of Selborne. By Gilbert White. With Notes, by Frank Buckland; a Chapter on Antiquities, by Lord Selborne; and New Letters. Illustrated by P. H. Delamote. London: Macmillan & Co. 1875. 8vo, pp. 591. $12.00.

Norse Mythology; or the Religion of our Forefathers. Containing all the Myths of the Eddas, systematized and interpreted. With an Introduction, Vocabulary, and Index. By R. B. Anderson. Chicago: S. C. Griggs & Co. 1875. 12mo, pp. 473. $2.50.

Principal Characters of the Dinocerata. Part I. By Prof. O. C. Marsh. With six plates. (From the American Journal of Science and Arts, February, 1876.) 8vo, pp. 6.

The Microscopical Examination of Crude Drugs and other Vegetable Products. By Prof. M. W. Harrington. Ann Arbor, Mich. 8vo, pp. 34.

Fresh-Water Shell-Mounds of St. John's River, Florida. By Jeffries Wyman. (Peabody Academy of Science, Fourth Memoir.) Salem, Mass. 1875. Royal 8vo, with nine plates, pp. 94. $2.00. For sale by the Naturalist's Agency.

Harbors of Alaska, and the Tides and Currents in their Vicinity By W. H. Dall. Appendix Coast Survey Report. Washington, D. C. No. 10. 4to, pp. 36. With a sketch.

Report of Geographical and Hydrographical Explorations on the Coast of Alaska By W. H. Dall. U. S. Coast Survey. Appendix No. 11. Washington, D. C. 4to, pp. 12. With a map.

[1] *The Movements and Habits of Climbing Plants.* By Charles Darwin. London: John Murray. 1875.

Report on Mt. St. Elias. By W. H. Dall. (From the U. S. Coast Survey Report for 1875.) With a map and sketches. Washington, D. C. July, 1875. 4to, pp. 32.

Notes on the Yucca Borer (*Megathymus yuccæ*). By C. V. Riley. (Trans. Acad. Sciences, St. Louis, January, 1876.) St Louis. 1876. 8vo, pp. 23. With cuts.

Note sur les Mollusques de la Formation Post-Pliocène de l'Acadie. Par G. F. Matthew. Bruxelles. 1875. 8vo, pp. 19.

On the Surface Geology of New Brunswick. By G. F. Matthew. (Canadian Naturalist, vii., No. 8.)

Remarks on the Variation in Form of the Family Strepomatidæ. With Descriptions of New Species. By A. G. Wetherby. Cincinnati. 1875. 8vo, pp. 12. With a plate.

Descriptive Catalogues of the Photographs of the United States Geological Survey of the Territories for the Years 1869 to 1875 inclusive. Second Edition. W. H. Jackson, photographer. Washington, D. C. 1875. 8vo, pp. 81.

GENERAL NOTES.

BOTANY.[1]

Astragalus Robbinsii Gray. — As some botanists seem to suppose this plant extinct, it may be of interest to them to know that the station has never been lost, and that at any time since Oakes used to collect it until now, fine specimens have been easily obtained. It is abundant over the very limited area where it grows, and has never been found anywhere else, I believe. Few plants are so exceedingly restricted in their range, for its habitat consists only of a space about five hundred feet long and from fifty to one hundred feet wide. This is on one bank of the Winooski River, near Burlington, where the limestone ledges are overflowed by every freshet. This limestone is very hard and compact, and full of crevices which are filled with sand mixed with a little mold. In these crevices, or less often in hollows that have been filled with earth, the astragalus grows, sending its roots from six inches to a foot or even more down into the crevice. It does not, so far as I have noticed, ever grow higher on the bank of the river than the spring floods reach, nor away from the exposed limestone rock. *Potentilla fruticosa* is found abundantly in the same location, and less abundantly *Anemone multifida* and *Campanula rotundifolia*, and also several less numerous species of *Compositæ*, *Salix*, etc. — G. H. Perkins.

The Potato-Blight. — A very important step has recently been made in our knowledge of the history of this disease. It is about thirty years since it was first clearly traced by M. Montagne in France, and the Rev. M. J. Berkeley in England, to a parasitic fungus, *Botrytis* or *Peronospora infestans*, which first attacks the haulms and leaves, and eventually causes the decay of the tubers. Two modes of asexual reproduction, by means of "simple spores" or conidia, and actively moving swarmspores or zoöspores which penetrate the stomata of the host, have

[1] Conducted by Prof. G. L. Goodale.

long been familiar to botanists; but it has been reserved for the well-known mycologist, Mr. Worthington G. Smith, of London, to discover quite recently the sexual mode of reproduction, which is quite analogous to that already known in other species of the same genus. On the mycelium, within the decaying tissues of the potato-plant, are produced the true sexual organs, the antheridia and oögonia, each of the latter containing a germinal cell or oösphere which is fertilized by a fecundating tube put out by the antheridium, which discharges its contents into the protoplasm of the oösphere, thus converting the latter into an oöspore or "resting spore." The germination of this latter body has not yet been observed. The chief point of practical importance in this discovery is that it disposes of the theory which had been started of an "alternation of generations," namely, that the spores of the potato-fungus germinate on some other plant than the potato, producing a fungus which had not been recognized as identical with the *Peronospora*, the spores of this again producing the potato-fungus. The ground which has to be worked over for the destruction of the disease is thus considerably limited. — A. W. B.

New Classification of Cryptogams. — In the last edition of his Lehrbuch der Botanik, Prof. J. Sachs proposes a new classification of the lowest section of cryptogams, which he distinguishes as *Thallophytes*, including the classes, hitherto considered distinct, of Algæ, Fungi, Lichens, and Characeæ. He divides the section into four classes, each consisting of two parallel series, the one containing chlorophyll and commonly known as Algæ (including Characeæ); the other destitute of chlorophyll and commonly known as Fungi (including Lichens). The classes are as follows: Class 1. Protophyta. This class comprises the simplest known forms of vegetable life, unicellular, or the cells connected into filaments, rarely into more complicated tissues; no mode of sexual reproduction is known. To the chlorophyll-containing series belong the *Chroococcaceæ*, *Nostocaceæ*, *Oscillatorieæ*, *Rivularieæ*, *Scytonemeæ*, and the *Palmellaceæ* (in part); to that destitute of chlorophyll the *Schigomycetes* (bacteria) and *Saccharomyces* (yeast). Class 2. Zygosporeæ. Asexual propagation various; sexual propagation by means of gygospores, the result of a process of conjugation. This is divided into two sections. In the first the conjugating cells are locomotive, as in the *Volvocineæ* and *Hydrodictyeæ* (containing chlorophyll), and the *Myomycetes* (destitute of chlorophyll); the second section includes the forms in which the conjugating cells are stationary, namely, in the first series the *Conjugatæ* (comprising the *Mesocarpeæ*, *Tyguerneæ*, *Desundieæ*, and *Diatomaceæ*); in the second series the *Tygomycetes* (comprising the *Mucorini* and *Piptocephalidæ*). Class 3. Oösporeæ. Reproduction by oögonia, containing an oösphere or embryonic cell, becoming an oöspore or resting-spore by the act of impregnation. In the series containing chlorophyll are *Sphæroplæa*, *Vaucheria*, the *Oedogoneæ*, and *Fucaceæ*; in the series destitute of chlorophyll the *Saprolegineæ* and *Peronosporeæ*.

Class 4. CARPOSPOREÆ. A distinct organ, or "sporocarp," results from the process of the fertilization of the female organ, or *carpogonium*. In the first series are the *Coleochætæ*, *Florideæ*, and *Characeæ;* in the second the *Ascomycetes* (including Lichens), *Aecidiomycetes*, and *Pasidiomycetes*. This classification of the lower Cryptogams appears to be founded on sounder principles and a more thorough knowledge of their structure, and especially their mode of reproduction, than any hitherto proposed. — A. W. B.

"TWINES WITH THE SUN." — A correspondent writes to inquire whether this expression, frequently applied to certain twining plants, is correct. He suggests that it might not apply to plants growing in the southern hemisphere. The expression "with the hands of a watch" is conveniently employed in place of the above, and seems to remove all possible ambiguity. If one wishes to guard more completely against captious quibbling, he may amplify the expression thus: "in the direction taken by the hands of a watch held face upwards, in front of the observer." — L.

SETS OF NAMED FUNGI. — We are glad to be able to state to the readers of the NATURALIST that Mr. Byron D. Halsted, Assistant in Botany at the Bussey Institution, Jamaica Plain, can furnish to any who desire, at $5.00 each, sets of fungi numbering fifty well-determined specimens in each set.

BOTANICAL PRIZES. — The following prizes were awarded in 1875, by the French Academy.

The Desmazières prize in cryptogamic botany was divided between M. Émile Bescherelle for his Mosses of Mexico and New Caledonia, and M. Eugène Fournier for his Ferns of the same countries. From the report we learn that three hundred and fifty-nine species of Mexican mosses have been identified by Schimper and Bescherelle. In New Caledonia there have been found one hundred and thirty species. Fournier gives five hundred and ninety-five species of Mexican ferns, one hundred and seventy-eight of which are peculiar to Mexico. He reports two hundred and fifty-nine species of ferns in New Caledonia.

The Barbier prizes for discoveries in medicine and botany were given to Albert Robin and M. Hardy for their investigation of the new drug, jaborandi, the leaves of *Pilocarpus pinnatus*, a plant of the rue family.

BOTANICAL PAPERS IN RECENT PERIODICALS. — *American Journal of Science and Arts*, February, 1876. Dr. Gray criticises at some length a recent paper by Naudin, On the Nature of Heredity and Variability in Plants.

Bulletin of the Torrey Botanical Club, New York, January, 1876. The question of the nativity in North America of some members of the gourd family is treated of at length by J. Hammond Trumbull, and on purely philological grounds the conclusion is reached that at least three species bearing Indian names were not known until they were

found and described in North America. Professor Eaton describes *Ophioglossum palmatum* Plumier, a rare fern detected by Dr. Chapman in Florida. *Cyperus Wolfii* is described by A. Wood.

American Agriculturist, February, 1876. How Flowers are Fertilized, by Prof. Asa Gray (devoted to compound flowers, with cuts of Leptosyne, a plant from the sea-shore in the southern part of California).

Nature, January 13, 1876. Fertilization of Flowers by Insects, xii. Further Observations on Alpine Flowers, by Herman Müller (with cuts of the corolla of *Rhinanthus alectorolophus*).

The Canadian Journal of Science, Literature, and History, Toronto, December, 1875. Plants of the Eastern Coast of Lake Huron, by John Gibson, B. A., F. G. S., and John Macoun, M. A. (A list comprehending the Phænogams, vascular Cryptogams, and the Mosses of the eastern coast of Lake Huron, and their distribution through the northern and western portions of British North America.)

The Monthly Microscopical Journal, January, 1876. Reproduction in the Mushroom Tribe, by W. G. Smith, F. L. S. (an account of reproduction in *Coprinus radiatus*).

Comptes rendus, December 20, 1875. Remarks on the Theories of the Formation of Saccharine Matters in Plants, and especially in the Beet, by Cl. Bernard. ("In the leaves of plants there exist sometimes starch, or dextrine, or glucose, or cane sugar, or inverted sugar. What has been said relative to the transfer and transformation of these saccharoid principles from the leaves to other parts of the plant has been based on hypothetical views, and not on experiments.") Boussingault remarked that the sugar of Agave is chiefly saccharose, formed and treasured up in the leaves.

Bulletin de la Société chimique de Paris, December 20, 1875. On the Presence of a Crystallizable Sugar in Germinating Cereals, by G. Kuhnemann. (The author isolated a small amount of sugar identical with saccharose, from sprouted barley.) Researches on Sugar and Dextrin in Barley, by G. Kuhnemann. (The author found no dextrine or glucose, but a crystallizable sugar and a substance to which he gives the name *sinistrine*.)

Bulletin mensuel de la Société d'Acclimatation, September, 1875. Useful Plants of Japan, by Dr. Vidal. (This paper enumerates the plants of Japan which yield food, drugs, and useful products.)

Atti della Società Italiana di Scienze Naturali, Vol. XVII. Fasc. III., 1875. Later Observations and Considerations respecting Dichogamy in the Vegetable Kingdom, by F. Delpino. The third and fourth parts of the work noticed in the NATURALIST for January, 1876, page 42.

Ofversigt af Kongl. Vetenskaps Akad. Förhandlingar, Stockholm, 1874. Descriptions of Mosses collected by N. J. Anderson during the Voyage of the Frigate Eugenie, 1851–53, by John Angstrom. (Includes Hepaticæ as well as true Musci.)

Flora, 1875, No. 29. Dr. J. Müller gives, in the form of an analytical key, some account of new Brazilian *Rubiaceæ*. (This is continued in No. 30.) Dr. Leopold Dippel replies, with great asperity, to a recent communication by Dr. Sanio respecting the nature of the cell-wall in cambium. No. 31. Dr. Lad. Celakovsky, On the Intercalated Epipetalous Circle of Stamens (continued in No. 32, not yet finished). On the Genesis of Coloring Matters in Plants, by Dr. Carl Kraus, of Triesdorff (treating of the relations of *chromogen* to the colors of flowers, etc.). No. 33. Lindberg's new classification of the fifty-nine genera of European *Hepaticæ* is reprinted from a memoir in Acta Societatis Scientiarum Fenniæ X. President's Clark's lecture On the Circulation of Sap in Plants, 1874, is criticised at some length. The reviewer is discriminating, and points out some possible errors of interpretation, but appears to have thoroughly appreciated the wide range of experiments, and the energy with which the work was done.

Botanische Zeitung, No. 52. On the Development of Cambium, by Dr. W. Velten (examining Prof. N. J. C. Müller's views in regard to the development of Cambium). Reports of Societies: *Berlin:* Brefeld on Development of Certain Fungi. This number contains an interesting obituary notice of Dr. Bartling, author of Ordines Naturales Plantarum (1830), and professor at Göttingen. Dr. Bartling was born at Hanover, December 9, 1798, and died November 19, 1875. No. 1 (January 7, 1876). On the Influence of Light on the Color of Flowers, by E. Askenasy. (This account of experiments is not yet finished.) A few notices of plants by Ascheron. Professor Pfeffer criticises with the greatest severity, in a book-notice, the recent paper on vegetable movements, by E. Heckel, of Montpellier. He insists that Heckel has not observed ordinary caution in his work, and his results are wholly untrustworthy. A notice of the paper and the review will be soon given in a general note.

ZOÖLOGY.

Bartramian Names again: An Explanation.— In Dr. Coues's reply to my critique upon his article on Bartram's ornithological names he seems to have misunderstood my admissions, inasmuch as he says I have yielded the very point I wished to refute. The point at issue is not whether "Bartram's identifiable, described, and binomially named species" are entitled to recognition, for no one would be foolish enough to deny that. The few names of this character in Bartram's long list, or the "five or six" among the *twenty* (not *ten*) Dr. Coues claims as Bartramian in origin, I have of course freely admitted. But I do not see how excluding about three fourths of the names claimed by Dr. Coues as properly originating with Bartram is admitting the main point at issue, which is the recognition of species *not* identifiably described. The *real* difference between us is as to what constitutes a description. While Dr. Coues considers that such vague references to species as

"¶ *Falco pullarius*, the chicken hawk," "* *Calandra pratensis*, the May bird," "* *Passer agrestis*, the little field sparrow," etc., are to be regarded as descriptions, especially if the coincidence of favorable circumstances renders it possible to *guess* with tolerable certainty what birds were meant, I do not. Neither do I consent that names such as these, whose application is mainly determinable by a process of exclusion based on the subsequent accumulation of knowledge for three fourths of a century, shall be taken to supplant others which have become familiar through long use, and which were originally accompanied by carefully and intelligently prepared descriptions, and in many cases also by admirable figures.

If Dr. Coues had insisted on the recognition of only those Bartramian names really identifiable by Bartram's descriptions, I should have accepted them without a word of protest; but when he coupled with them three times as many more which can be determined only on some other basis, and then rarely with any degree of certainty, I deemed it an innovation not to be quietly endured. I am very glad to see that even Dr. Coues himself has abandoned this extreme ground in his reply to my critique.

In conclusion I may say that I do not feel that Dr. Coues gave the reference to Bartram's recognition of the variation in size in animals of the same species from different localities quite the consideration it merits, for Bartram not only observed the facts, but correlated them into a general statement, and even raised the inquiry whether these differences be not the result of conditions of environment, — whether "the different soil and *situation of the country* may have contributed in some measure in *forming and establishing* the difference in *size and other qualities* betwixt them." — J. A. Allen.

Pelicans in San Francisco Bay. — Pelicans (*P. fuscus*) are unusually numerous in San Francisco Bay this season, especially on the eastern side, along the Oakland shore. Recently, during a dense fog, a white pelican (*P. erythrorhyncus*) measuring ten feet from tip to tip of wings flew into the arms of a man in San Francisco. — R. E. C. Stearns.

Bears and Panthers on the Pacific Coast. — Nine cinnamon bears were recently caught with steel traps on a ranch on the coast near Bodega Corners, Sonoma County, California; and William Bonness, a settler on the Little Chico, in Butte County, killed last month a family of California lions consisting of the parent pair and two cubs. Robert Ford also killed three in Oregon last month, and one was recently killed near Seattle, W. T., which measured nine feet four inches in length.

Deer are plentiful in San Bernardino County, and robins and larks are unusually abundant in the orchards of Santa Cruz, California. — R. E. C. Stearns.

The Sea-Lions and other seals which frequent the rocky islets near the entrance to San Francisco Bay, at Point Lobos, have heretofore been

protected by law, having been regarded as objects of interest and curiosity to the San Franciscans and strangers visiting the neighborhood. The Cliff House at the point is a famous resort, and the road leading to it from the city a favorite drive; these animals, which are quite numerous, are a conspicuous feature in the attractions of the locality. The state fish commissioners, who are diligently working to stock the waters of the State with food fishes, find that the results of their labors are impaired through the voracity of the seals, which occupy a station especially favorable for preying upon the finny tribe. Recently a bill has been introduced in the legislature to repeal the protective act and to encourage their extermination.

It may well be questioned, however, whether more harm is not done by the Chinese fishermen who drag the waters inside of the bay and sweep them of everything that has life, whether fish or crustaceans, without regard to "age or condition," and who dry their "catch" for export either to the interior or to their native land. The amount of fish-food and of young fish thus caught and dried is undeniably very great, and should in some manner be regulated or controlled by legislation. The papers have recently contained an account of an attack on a boat made by a sea-lion. "As a Mexican Indian named Sacramentus was crossing Tomales Bay at Marshall, the boat was attacked by a large sea-lion. The Indian dealt the beast a heavy blow on the head with a hatchet, but without repulsing the animal, which again attacked the boat, with renewed fury. It was finally killed and afterward towed ashore. The fishermen estimated its weight at twelve hundred pounds." — R. E. C. Stearns.

Eyes and no Eyes. — In the chætopod worms of the cold deep water of the Atlantic "we miss neither the colors nor the eyes which are met with in coast regions" high north. Ehlers believes that these colors and eyes are preserved in the lightless depths in consequence of "new animals ever migrating down from the brighter layers of water, and so preventing the disappearance of these parts." As the surface animals go southward and into water warmed superficially by the Gulf Stream, they retire into the depths. To this Ranke, in the same volume (xxv.) of the *Zeitschrift für wissenschaftlich Zoölogie*, adds another pregnant suggestion as to the persistence of eyes where they seem to be useless; namely, that in leeches their very simple eyes have also sensations of touch and taste; indeed, that they are not simply eyes which may upon occasion serve other ends, but rather neutral organs of sense which can act in various directions, as needs in the long run may require. Some confirmation of this "appears partly from the fact that organs quite similar to these so-called eyes on the head of the leech occur also in the whole of the rest of the body." We take these statements from a German correspondent of *Nature*, November 25th.

Remarkable Habits of a Tree-Frog. — Professor Peters has re-

cently described the mode of deposit of its eggs employed by a species of tree-frog (*Polypedates*) from tropical Western Africa. This species deposits its eggs, as is usual among batrachians, in a mass of albuminous jelly; but instead of placing this in the water, it attaches it to the leaves of trees which border the shore and overhang a water-hole or pond. Here the albumen speedily dries, forming a horny or glazed coating of the leaf, inclosing the unimpregnated eggs in a strong envelope. Upon the advent of the rainy season, the albumen is softened, and with the eggs is washed into the pool below, now filled with water. Here the male frog finds the masses, and occupies himself with their impregnation.

A Snake-Eating Snake. — Some years ago Professor Cope described the snake-eating habits of the *Oxyrrhopus plumbeus* Wied, a rather large species of snake which is abundant in the intertropical parts of America. A specimen of it from Martinique was observed to have swallowed the greater part of a large *fer-de-lance*, the largest venomous snake in the West Indies. The *Oxyrrhopus* had seized the *fer-de-lance* by the snout, thus preventing it from inflicting fatal wounds, and had swallowed a great part of its length, when caught and preserved by the collector. More recently a specimen was brought by Mr. Gabb from Costa Rica, almost five feet in length, which had swallowed nearly three feet of a large harmless snake (*Herpetodryas carinatus*) about six feet in length. The head was partially digested, while three feet projected from the mouth of the *Oxyrrhopus* in a sound condition. The *Oxyrrhopus* is entirely harmless, although spirited and pugnacious in its manners. Professor Cope suggests that its introduction into regions infested with venomous snakes, like the island of Martinique, would be followed by beneficial results. The East Indian snake-eater, *Naja elaps*, is unavailable for this purpose, as it is itself one of the most dangerous of venomous snakes.

ANTHROPOLOGY.

Anthropological Notes. — In the third part of the *Bulletin de la Société d'Anthropologie* for 1875 is a paper by M. Coudereau on articulate sounds, with five tables of classification. This paper merited sufficient attention to justify the appointment of a committee consisting of MM. Chauvée, Picot, Hovelacque, Coudereau, De Caix St. Aymour, Millescamps, De Charencey, Andre Lefevre, Krishaber, Parrot, Proust, Waisse, and Onimus to examine into its merits. The same subject was discussed at subsequent meetings. In the same number, M. de Mortillet reported the reception of a letter from M. Babert de Juillé, announcing the discovery of a trepanned skull in the dolmen of Bougon in Deux Sevres. M. Broca stated that this was the fifth locality wherein this custom had been traced.

Part xvii. of Reliquiæ Aquitanicæ has been received, containing the

conclusion of the paper on the Fossil Man from La Madelaine and Laugerie Basse; Notes on the Caribou of Newfoundland, by T. G. B. Lloyd; Notes on Ovibos moschatus, by E. Lartet; supplemental notes, and a series of indexes to the whole work.

In the third part of *Revue d'Anthropologie*, Dr. Berenger Feraud has a long and deeply interesting article upon the Oulofs of the Coast of Senegambia, embracing descriptions of their physical characters, manners, customs, intellectual characters, children, habitations, nourishment, language, the family and social organization.

Before the British Anthropological Institute, November 9th, Mr. Francis Galton read two papers: one on Heredity in Twins, the other on A Theory of Heredity. It appears that twin-bearing is hereditary, and that it descends through males and females about equally. In the latter paper it is argued that the germs which were selected for development into the bodily structure had a very small influence from a hereditary point of view, while it was those germs which were never developed but which remained latent, that were the real origin of the sexual element. This accounts for much that Mr. Darwin's theory of pangenesis over-accounted for, and is free from objections raised against the latter.

Dr. Robert Brown has translated Dr. Rink's celebrated work entitled Tales and Traditions of the Eskimo, with a Sketch of their Habits, Religion, Language, and other Peculiarities. Blackwood and Sons, of Edinburgh, are the publishers.

At the session of the Anthropological Section of the French Association, August 25th, M. de Mortillet advanced a new theory of the origin of bronze. After reviewing the countries where copper and tin are found, he concludes that bronze implements and weapons took their origin in India. He bases his conclusions mainly upon the following facts: Mysorine, the most reducible ore of copper, is found principally in India. In the peninsula of Malacca, and notably in the Isle of Banca, are found the richest deposits of tin in the world. The shortness of the handles of bronze weapons is paralleled by those of India at the present time. Finally, in the lacustrian deposits of the bronze age of Switzerland and Savoy, strange-shaped objects are found which have their analogues only in India. As an indication of the origin of the white-skinned races of Northern Africa, we find many of the same forms prevailing amongst them.

Among the exceedingly interesting objects brought from the Rio San Juan by Professor Hayden's party is a Peruvian double bottle or jar, similar in every respect to many of the whistling bottles of the last-named country. Whether this is an accidental resemblance or an article of commerce I am unable to say.

The Rev. M. Eells has sent to the Smithsonian Institution a manuscript of one hundred and sixty pages, containing a full account of the Twamish Indians of Hood's Canal, Puget's Sound. Nothing in connec-

tion with American ethnology is more desirable than that every Indian agent in the country would furnish us with a manuscript of the tone and tenor of this splendid work. — O. T. Mason.

American Archæology. — Two very interesting pamphlets have been published recently in Rio Janeiro, from the pen of Professor Ch. Fred Hartt: one entitled Amazonian Tortoise Myths, the other, Notes on the Manufacture of Pottery among Savage Races. In the former we have from the Lingua Geral, or modern Tupi language, spoken at Ereré, Santarem, and on the Tapajos River, the fables founded on the exploits of the Jabuti or tortoise, and other mythical animals, — monkeys, tapirs, buzzards, etc. In the latter is an account of the process of pottery-making and ornamentation, embracing the materials, the tools, the processes, and the products, together with a copious bibliographical reference.

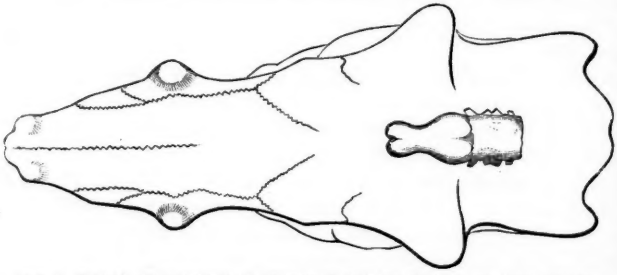
M. Roban, in the second number of *Le Musée Archéologique*, speaks of the handles used for flint hatchets by the ancient Mexicans. Among others he draws attention to weapons formed by inserting bits of obsidian in a grooved wooden handle, resembling the Polynesian shark's-teeth spears and swords. These obsidian weapons are described and figured in Schoolcraft, v. 290, and in the Smithsonian Contributions, vol. xi., art. ix., p. 180.

Mr. Hyde Clarke has published in pamphlet form, through Trübner & Co., an article from the *Journal of the Anthropological Institute*, entitled Researches in Prehistoric and Protohistoric Comparative Philology, Mythology, and Archæology, in connection with the Origin of Culture in America and the Accad or Sumerian Families. The design of the author is, in his own words, "to bring archaic philology into reunion with those nascent studies of anthropology, archæology, and mythology, which have met with acceptance and popularity." He has elsewhere spoken of the similarity between the Agaw of the Nile and the Abkhass of the Caucasus with the Omagua and Guarani of Brazil. He first draws attention to the Pygmæan and other so-called prehistoric races of North and South America, of Africa, and of the islands of the Pacific Ocean, and then by parallels of culture he reviews the tribes of the two hemispheres, somewhat similarly to the plan pursued by E. B. Tylor in tracing the growth of culture, and by Colonel Lane Fox in following the evolution of implements and weapons. He regards, for philological purposes, Egyptian, Sumero-Peruvian, Chinese, Tibetan, and Dravidian languages as protohistoric. In addition to resemblances of language between the continents, the author enforces his opinions by parallels of racial characters, by similar customs of head-shaping, deformations of teeth, ears, and other members, circumcision, monumental mounds, monolithic and megalithic monuments, statues, towers, and ossuaries; by their metallurgy, masonry, pottery, and weaving; by their like myths and beliefs; by their calendars, and by their social and

domestic customs. The author favors the view of Mr. Park Harrison and Professor Owen that migrations to America proceeded by the Sandwich and Easter Islands as well as by Behring Strait. He concludes by affirming that "the whole of the phenomena of man in America represent an arrested development of civilization, cut short, as compared with Europe and Asia, at a time so remote that in the Old World the great religions of the globe, Judaism, Christianity, and Islam, had time to cover the Eastern hemisphere, while until the Spanish conquest the Americas had in the flux of centuries never heard their revelations." — O. T. Mason.

GEOLOGY AND PALÆONTOLOGY.

The Brain of the Dinoceras. — This extinct animal, discovered by Professor Marsh in the Eocene beds of Wyoming, nearly equaled the elephant in size, but the limbs were shorter. The head could reach the ground, and there is no evidence that it carried a proboscis. Professor Marsh figures the skull in his second memoir, entitled Principal Characters of the Dinocerata (*American Journal of Science*, February, 1876).



(Fig. 9.) SKULL OF DINOCERAS, SHOWING RELATIVE SIZE OF THE BRAIN.

The accompanying cut (Fig. 9) gives an outline of the skull (seen from above, one eighth the natural size) of *Dinoceras mirabile*. The central figure near the base of the skull illustrates the remarkably small brain. Says Professor Marsh, "The brain-cavity in *Dinoceras* is perhaps the most remarkable feature in this remarkable genus. It proves conclusively that the brain was proportionately smaller than in any other known mammal, recent or fossil, and even less than in some reptiles. It was, in fact, the most reptilian brain in any known mammal. In *D. mirabile* the entire brain was actually so diminutive that it could apparently have been drawn through the neural canal of all the presacral vertebræ, certainly through the cervicals and lumbars."

Mountain-Making. — An abstract of Professor Suess's memoir on the Origin of the Alps has been furnished the *American Journal of Science* by Mr. E. S. Dana, which we further condense, often using the exact language of the abstract. According to the views of the early geol-

ogists, still widely accepted, the origin of mountains is to be ascribed to the elevation of a molten or semi-molten mass which threw up the rocks along its axis, and crowded the upper strata to the right and left, forming in this way a mountain-chain. But this view is not sustained by observed facts, and Suess adopts the modern view of a general horizontal movement of the mountain system as a whole. The conclusions of Suess agree to a very considerable extent with those of Professor Dana in his discussion of mountain-making in general.

In the Alps the exertion of this horizontal force was essentially influenced by resistance from four different sources: (1) from the presence of foreign masses of older rocks; (2) from the folding mass itself; (3) from the occasional introduction of older volcanic rocks, as granite and porphyry, in the moving mass; (4) finally, it appears that single mountain masses, like the Adamello or the red porphyry, near Botzen, have exerted an essential influence on the development of the surrounding mountain region.

If we look at the subject more broadly, however, and pass out of Europe to America, and then further study the great mountain-chains of Asia, we arrive at this grand conclusion: throughout, mountain-masses and mountain-movements are *one-sided*, and the direction of the movement is in general northwest, north, or northeast, in North America and Europe, but southerly or southeasterly in Central Asia. There is no regular geometrical arrangement in mountain-chains.

In conclusion, it may be remarked that mountain-making as a whole can be regarded as a stiffening of the earth's surface, which process has been determined by the distribution of certain older rigid masses. These may be made up of mountain lines pushed up together and crossing each other, as in Bohemia, or they may consist of widely extended surfaces whose strata, even the oldest, have retained their horizontal position, as in the great Russian plain. These primitive masses conform to no geometrical law, either in outline or in distribution, though they have determined the form and course of the folds which contraction has produced in the more pliant portions of the earth's surface between them.

GEOGRAPHY AND EXPLORATION.

Exploration of the Upper Madeira Plate. — Professor James Orton, of Vassar College, is preparing for a third expedition to South America. He purposes to explore the unknown parts of the Upper Madeira Plate, the Rio Beni in particular. This magnificent river, the largest tributary to the Madeira, has never been explored; its course is as much a geographical problem as the source of the Nile. The mysterious Madre de Dios is supposed to be an affluent, but it remains to be proved. Lieutenant Gibbon was charged by our government to settle the question, but he failed in the attempt. Professor Orton intends to examine this river mainly in the interest of geographical science; but

its natural history and commercial resources will receive all possible attention. To archæologists this must be an intensely interesting field, as the Beni region was the treasure-land of the Incas; while to zoölogists it is a paradise of new forms. Said Dr. Sclater in his address before the British Association, "There is no part of South America which I would sooner suggest as a promising locality for the zoölogical collector."

The Aleutian Islands. — We have received copies of a Report of Geographical and Hydrographical Explorations on the Coast of Alaska, by W. H. Dall, assistant in the Coast Survey. It is accompanied by a map of these islands on an extended scale, and contains many corrections of previous maps.

Mount St. Elias. — In an elaborate account of Mount St. Elias printed in the forthcoming report of the Coast Survey, Mr. Dall publishes a map of the neighboring Alaskan coast, with sketches of Mount St. Elias and Mount Fairweather. The former he estimates to be 19,500 feet in height, while Mount Cook, which is sometimes mistaken for it, is 16,000 feet high. Mr. Dall thinks that Mount St. Elias is not an extinct volcano, through the great amphitheatre on the southeast flank may possibly be the crater of an extinct volcano; still this is doubtful. "Preëminent in grandeur," says Mr. Dall, "is the southern face of this mountain. With few and but insignificant foot-hills, it rises abruptly from the valley; and at about five thousand feet above its base, the entire side of the mountain is formed of an immense rock-face, inclined at an angle of 45° to the sea, rising eight or ten thousand feet without a break in its continuity. It terminates somewhat irregularly above, and the upper contours of the peak remind one of the granite peaks of the Californian Sierras. The apex is pyramidal, sharp, and clearly cut, leading to the inference that it is precipitous on the invisible northern side." There are no glaciers on the flanks of this mountain, but, owing to the topographical features of the peak, great snowfields; while there are four glaciers on Mount Fairweather, and at the head of the Bay of Yakutat, which lies between the two mountains, "glaciers come down to the sea, and send their floating fragments, laden with earth and stones, out into the sea." These glaciers have apparently always been local, as "the character of the topography is such that it is inconceivable that a continuous glacier, moving in any direction, could have ever covered the western slope of these mountains." The statement of a Russian sailor that Mount St. Elias sent forth flames and ashes is regarded as untrustworthy.

MICROSCOPY.[1]

Microscopy at the American Association. — At the Detroit meeting of the American Association for the Advancement of Science, last August, the microscopists who were in attendance decided to organize permanently a subsection or club, connected with the association.

[1] This department is conducted by Dr. R. H. Ward, Troy, N. Y.

To allow ample time for preparation, and to facilitate the coöperation of all interested parties, it was decided to adjourn for one year, and to proceed with the organization at the Buffalo meeting of the association, which commences on the third Wednesday of August next and continues about one week. All persons interested in the microscope, and desirous of joining such an organization as is now proposed, are invited to be present and coöperate, whether at present members of the association or not, and are requested to bring to the meeting original papers of scientific interest upon subjects connected with the microscope and its work, and also to bring instruments, accessories, and objects, especially those illustrating new or unfamiliar inventions, contrivances, and discoveries.

It is hoped that the participation of microscopists in this movement will be prompt and cordial. The general desire for a national organization has become a positive necessity, and it is believed that success could be in no other way be so fully obtained as by meeting in connection with the American Association, whose character and influence could not fail to be an advantage, whose meetings are necessarily held only at the most available times and places, and whose elaborate arrangements for the convenience and economy of members attending are designed for the benefit of scientists in every department. The recent accession of the chemists, the ethnologists, and the entomologists marks the tendency of the association to become a general congress of American scientists. In meeting with the American Association the microscopists will enjoy a more than double advantage, but separated from it they would lose from their number those who desire to attend the meetings of the association and whose business or other convenience might interfere with the additional journey and absence demanded by a second meeting.

American Postal Micro-Cabinet Club. — A year's experience in the working of this organization has already given it the position of a useful and well-sustained institution. The first announcement of the formation of the club was so favorably received that an unexpectedly large number of members was enrolled, since which time its membership has steadily increased until it now numbers twelve circuits of members, distributed over the whole country east of the Rocky Mountains. With the exception of a remarkably small number of accidents to objects while in transit by the mails, which it is believed will be still fewer in the future, the club has met with no practical difficulties or disappointments. The general excellence as well as the variety of objects contributed has been conspicuous; and those members, if there are any, who can learn but little from the work of others in various departments of the science must at least feel that they have contributed widely to the advantage of others at very little trouble to themselves. In addition to the circulation and study of mounted objects, critical notes upon the same, questions and answers, and announcement of duplicates for exchange, it is proposed to add during the present year the exchange of

microscopic objects and material, whether mounted or unmounted, not necessarily connected with the slide contributed; any member adding at the bottom of his note a statement of offers or wants, and other members addressing him directly by mail, in regard to the same.

SCIENTIFIC NEWS.

— The fifth Bulletin, second series, of the United States Geological and Geographical Survey of the Territories contains the following papers: A Review of the Fossil Flora of North America, by Leo Lesquereux; Notes on the Geology of some Localities near Cañon City, by S. G. Williams; Some Account, Critical, Descriptive, and Historical, of *Zapus Hudsonius*, by Dr. Elliott Coues; On the Breeding-Habits, Nest, and Eggs of the White-Tailed Ptarmigan (*Lagopus leucurus*), by Dr. Elliott Coues; List of Hemiptera of the Region west of the Mississippi River, including those collected during the Hayden Explorations of 1873, by P. R. Uhler; On some New Species of Fossil Plants of the Lignitic Formations, by Leo Lesquereux; New Species of Fossil Plants from the Cretaceous Formation of the Dakota Group, by Leo Lesquereux; Notes on the Lignitic Group of Eastern Colorado and Wyoming, by F. V. Hayden; On the Supposed Ancient Outlet of Great Salt Lake, by A. S. Packard, Jr. The paper by Mr. Uhler occupies about a hundred pages, and contains numerous descriptions of new forms and is illustrated by three excellent plates.

— On the 13th of October, 1875, The Cincinnati Geological Society was organized with the following officers: President, Harold B. Wilson; Treasurer, Chas. Schuchert; and Recording Secretary, Chas. B. Morrell.

— A Summer School of Biology will be opened in the Museum of the Peabody Academy of Science, Salem, Mass., beginning July 7th and continuing six weeks. Especial attention will be given to marine botany and zoölogy, as the advantages for dredging and shore collecting are most excellent. The museum of the academy is situated within less than five minutes' walk of the wharves, while the cars and omnibuses run often to the beaches and good collecting-grounds. The number of students will be limited to fifteen, and while the school is designed primarily for the teachers of Essex County, Mass., a few others can be admitted. Board can be obtained for $5 a week and upwards.

Instruction in botany will be given by Mr. John Robinson, with the assistance of Mr. C. H. Higbee; and in zoölogy by A. S. Packard, Jr., with the assistance of Messrs. J. S. Kingsley and S. E. Cassino. Mr. C. Cooke will have charge of the dredging parties. Special instruction will be given in microscopy by Rev. E. C. Bolles. Prof. E. S. Morse and several other naturalists of distinction will probably give an occasional lecture. An admission fee of $10.00 will be charged. For further particulars apply to A. S. Packard, Jr., Peabody Academy of Science, Salem, Mass.

— A careful examination of the papers left at the Smithsonian Institution by the late Dr. Stimpson has revealed the existence of the complete MSS. of his final report on the Crustacea of the North Pacific Exploring Expedition as far as the end of the Anomoura, with beautiful figures of one hundred and thirty-seven of the new species. It was supposed that these had perished with Dr. Stimpson's other MSS., and with the collections they described, in the great Chicago fire. We trust they will soon be published.

— Among the Swedish contributions to the Centennial Exhibition will be a number of articles of a fine red granite, that takes as high a polish as the well-known Scotch granite, and among the manufactures of the beautiful porphyry found in Elfdal, in the province of Dalarne, will be a table belonging to the king, which cost ten thousand dollars. A meteorite, weighing ten thousand pounds, sent by the discoverer, Professor Nordenskiöld, will attract notice. From the Hawaiian Islands will be sent to the exhibition a model of the islands, made to a scale, showing their physical geography and topography, and the mountains, valleys, woods, forests, rivers, volcanoes, etc.

— Major Powell has gone West among the Indians for the purpose of obtaining casts of the features of the Indian tribes. He has given much attention to collecting linguistic and historical documents concerning the Pueblos of New Mexico.

— Mr. J. Matthew Jones, of Halifax, proposes to publish shortly in *Psyche* a list of the few insects known to inhabit the Bermudas. They are mostly of a Floridan or West Indian type.

— Nordenskiöld reports that at Cape Schaitanskoj, the most northerly point on the Jenesei River, Dr. Stuxberg discovered a species of fresh-water snail (*Physa*). This is the most northerly locality for land and fresh-water mollusks.

— Mr. J. T. Humphreys, of Atlanta, Georgia, has been appointed State Entomologist of Georgia.

— *Nelumbium luteum*, according to a popular writer in one of the monthlies, is "the sacred lily of the East," is "a beautiful blossom," and "is said to have been introduced into this country from Europe by a member of the Gadsden family." The latter statement is rather discredited by the writer, who adds that "it grows wild in Florida," and was probably brought to South Carolina by Michaux. All this may be put about right by a slight correction: The plant is not the sacred lily of the East — meaning the Indian *Lotus;* though a large blossom, it is not beautiful; it belongs only to this continent, and grows wild from Florida to Wisconsin and Connecticut.

— The sixth Bulletin, second series, of Hayden's United States Geological and Geographical Survey of the Territories, finishes volume i. for 1874 and 1875. It contains the following papers: An Account of the Various Publications relating to the Travels of Lewis and Clarke, with a Com-

mentary on the Zoölogical Results of their Expedition, by Dr. Elliott Coues; Notice of a very large Goniatite from Eastern Kansas, by F. B. Meek; Fossil Orthoptera from the Rocky Mountain Territories, by S. H. Scudder; Studies of the American Falconidæ, Monograph of the Polybori, by Robert Ridgway.

— At the second meeting, held in Boston, of those interested in mountain exploration, the name "Appalachian Mountain Club" was adopted. Prof. C. H. Hitchcock exhibited a model of the White Mountains, and Mr. Sweetser presented the report of the committee on the nomenclature of the White Mountains, and the club voted to adopt a number of names which the committee recommended.

PROCEEDINGS OF SOCIETIES.

Academy of Sciences, San Francisco, Cal. — December 20, 1875. A memorial to the legislature, praying that the Geological Survey be resumed, was adopted. It was stated in the memorial that there have been published four volumes of the geological reports, namely, one of geology, two of palæontology, and one of ornithology, besides smaller pamphlets and several topographical maps, the beauty, accuracy, and value of which are appreciated and acknowledged by all who have carefully examined them. Of the unpublished matter already accumulated, there is the material for a second volume of geology, for a volume of botany nearly ready to be issued, and the greater portion of the material for a second volume of ornithology, devoted to the aquatic birds. The map of Central California is so nearly finished that the active field-work of one more season would complete it. This map embraces nearly one half the area of the State, extending from Lassen's Peak on the north to Visalia on the south, and includes all the more important mining districts within the limits of California. The work so far done upon it is unexceptionable, and when completed it will possess the highest practical value, will meet with a ready sale, and will be the most important contribution to the geography of this coast that has ever been made. A general geological map of the whole State has been partially drawn and colored, and could be finished and published in such a way as to show the extent of the present knowledge of the geology of the State (subject, of course, to such improvements in detail as may hereafter be developed by future works), at no great expense. The United States Coast Survey map of the peninsula of San Francisco has been geologically colored in great detail, and only waits the means for its publication.

Philosophical Society of Washington. — January 15, 1876. Major J. W. Powell addressed the society on types of mountain-building, describing the characteristics of the mountains in the regions covered by his explorations.

January 29th. Mr. W. H. Dall read a paper on the succession in the

shell-heaps of the Aleutian Islands. He showed that they were separated into three successive periods, indicated by the remains of food contained in the shell-heaps, namely, lower or Echinus layer (Littoral Period), composed of the remains of Echini and mollusk-shells; middle or fish-bone layer (Fishing Period), composed principally of the remains of fish; and lastly, the mammalian layer (Hunting Period), composed principally of bones of sea animals and birds. Above all this came the remains of the more modern village sites.

The first period might have extended over a thousand years; the length of the others there is no means of approximating. The first layer contained few and very rude implements, and a gradual progression was observed in the variety and finish of the implements and weapons of the succeeding layers. Only toward the last were there any signs of the use of houses, fire, or ornamentation of tools or other articles. The character of the latter showed that the early inhabitants formed their tools and weapons after the Eskimo patterns, but these gradually became differentiated into a type peculiar to the islands. Mr. Dall considered it probable that the first inhabitants were Eskimo of a low type, who took to the islands for protection, coming from America, and in their restricted surroundings in the course of ages developed into a special type, without entirely effacing the links which connect them with the Eskimo in language, physique, and fabrications.

Dr. Bessels read a paper on the hygrometric properties of the atmosphere in the Arctic regions.

Boston Society of Natural History. — January 19th. Mr. T. T. Bouvé read a paper on the origin of porphyry, in which it was claimed that the rock was an altered conglomerate. Professor Hyatt exhibited a geological map of Marblehead Neck. The conglomeritic character of the porphyries of this locality were particularly dwelt upon, and a large series of specimens exhibited. A paper by Mr. L. S. Burbank on the conglomerates of Harvard, Mass., and their relations to the crystalline rocks, followed.

February 2d. Dr. W. K. Brooks read a paper on the development of *Astyris* (Columbella) *lunata*. This is the first siphonated gasteropod whose embryological history has been followed. Some general views on the molluscan pedigree were added. Mr. S. H. Scudder read a paper on the way in which cockroaches and earwigs fold their wings.

Academy of Natural Sciences, Philadelphia. — February 4th. The collections of the academy are being arranged as rapidly as possible in the new building, and it is hoped that the museum will be thrown open for the inspection of the public early in the coming spring.

Professor Cope exhibited a fragment of a leg-bone of a fossil bird discovered by him during the explorations in New Mexico conducted by Lieutenant Wheeler. It resembles in many points those of the ostrich and the extinct Dinornis of New Zealand, and its size indicates a species

twice the bulk of the former. The discovery introduces this group of birds to the known faunæ of North America, recent and extinct, and demonstrates the fact that this continent has not been destitute of the gigantic forms of birds now confined to the fauna of the southern hemisphere. A description of the fragment was given, the peculiarities which distinguish it from the corresponding part of its nearest allies were dwelt upon, and the name *Diatryma gigantea* was proposed for the form indicated by it.

Professor Frazer exhibited eight geological maps of Yesso, lately received from Benjamin Smith Lyman, Geologist-in-Chief of Japan.

Mr. Henry Carvill Lewis remarked that it might be of interest to mention the occurrence of strontianite in Pennsylvania — a mineral which he believed had not been heretofore recorded as occurring in our State. He had found it quite abundantly in Mifflin County, on the Juniata, opposite Mount Union. It exists as white tufts of rhombic crystals lining pockets in limestones, or, when in shale, disseminated throughout the rock-mass.

A paper entitled Description of a New Generic Type, *Bassaricyon Gabbii*, of the *Procyonidæ*, from Costa Rica, by J. A. Allen, was presented for publication.

California Academy of Sciences. — At the late annual election, Prof. George Davidson was elected president. At the meeting of January 17th, Henry Edwards read descriptions of new species of Lepidoptera, and a resolution was adopted, the object of which was to sectionize the academy.

Academy of Science, St. Louis. — January 17th. Dr. Richardson exhibited a skull and some specimens of pottery obtained from a mound "near the stock-yards" at East St. Louis. The mound was about ten feet high, and forty feet in diameter at its base. At a depth of six or seven feet, eighteen skulls were found. The bodies had been laid in a circle, with the heads outward. Many of the skulls were fractured on the temporal bone. He had also found eighteen graves in the bluffs on the Belleville or "rock" road. These bones were found under slabs of stone, with some article of pottery near the head.

Mr. Theo. Allen exhibited some pottery and skulls found in mounds in Southeast Missouri. The mounds were near a swamp, and inclosed in an earth-work about a quarter of a mile square. Three mounds were opened. In only one were human remains found. Here were discovered the skulls, arms, and legs of many skeletons. No vertebræ or ribs were found. The bodies had been placed in a circle, with the heads inward. The skulls were nearly all flattened on the left side, and pressed out on the right side, but lay with the face upward. Many articles of pottery were found with the skulls. Mr. Allen stated that many of these adult skulls possess rudimentary teeth. Within the inclosure were also found many sink-holes, laid out in regular order, which had once served as

human habitations. Specimens of dried brick which had been used to plaster over these rude habitations were also found. Mr. A. J. Conant also exhibited some skulls, and implements of bone and stone, found by him in caves in Pulaski County, Mo., on the Gasconade River.

Academy of Sciences, New York. — January 24th. The president, Dr. J. S. Newberry, made a communication on Fossil Fishes and Foot-Prints from the Trias of New Jersey, in which he announced his rediscovery of an old and important locality, which had been for many years forgotten or lost. Boonton, New Jersey, lies at the junction of the Trias with the gneiss range of the Highlands; and close to the village occur two adjacent beds of shale, in the Triassic sandstone. These layers are literally crowded with fishes, for the most part in a very perfect condition, showing no traces of slow decay, but rather of sudden destruction and burial. Many fine specimens were procured, but only one species had been definitely recognized, *Catopterus gracilis*.

He also exhibited very fine and large tracks from the Triassic sandstones at Pompton, a few miles from the fish locality. They have the same characters as the three-toed reptilian foot-prints (the so-called "bird-tracks") of the Connecticut Valley. The evidence is ample that this great tribe of bird-like reptiles had a very considerable development in our American Mesozoic, reaching on well into the Cretaceous in the forms of Hadrosaurus and Lælaps.

Prof. D. S. Martin presented an account of the Occurrence of Silurian Fossils in the Drift of Long Island. The fossils are characteristic Brachiopods of the Delthyris shaly limestone (especially *Strophodonta Beckii* and *S. Headleyana*) from a large bowlder in the heavy drift of Long Island, at Willett's Point. A like circumstance has lately been noted in the Proceedings of the Philadelphia Academy, — the finding of Oneida and Medina bowlders at West Philadelphia. The questions arising are the same in the two cases, namely, as to whether the transporting agent was glacier-ice or bergs. If the former, the distance over which the ice-sheet actually moved (in the present case nearly one hundred miles) is quite beyond our usual estimate, at least in this region, and would also require that the glacier should have overridden the range of the Blue Ridge Highlands entirely. On the other hand, if icebergs were the agents, they must needs have passed through the narrow gaps in that range now occupied by the Hudson, in this instance, and by the Delaware, Lehigh, or Schuylkill, in the other. The finding of some oysters (apparently *O. borealis*) with the Long Island bowlder would indicate clearly that floating ice was the agency of transportation.

Mr. Henry Newton, of the United States Black Hills Expedition, exhibited a large series of rocks and of Cretaceous and Jurassic fossils, collected by the party last summer, and described their occurrence somewhat in detail. The rocks included Potsdam sandstone, Huronian slates, and granites of two very distinct types; one of these Mr. Newton re-

gards as Laurentian, and the other as eruptive, and subsequent to the deposition of the Potsdam, at least, as that rock contains no fragments of it, though full of pebbles from the Huronian.

Troy Scientific Association. — January 17th, annual meeting. Dr. R. H. Ward was elected president, and Rev. A. B. Hervey and Wm. E. Hagen vice-presidents. Dr. Ward delivered an address on the Petrified Forest of California. He considered the peculiar fracture of the fallen petrified trunks their most suggestive and important peculiarity since they are broken up somewhat symmetrically in a manner that might happen to wood rendered brittle by charring or perhaps by partial petrifaction, but could hardly be conceived as occurring to ordinary wood or stone.

SCIENTIFIC SERIALS.[1]

Quarterly Journal of Microscopical Science. — January. On the Structure of Hyaline Cartilage, by G. Thin. Further Observations on a Peach or Red Colored Bacterium, by E. R. Lankester. On the Development of Teeth, by C. S. Tomes. An Account of Professor Haeckel's Recent Additions to the Gastræa Theory, by E. R. Lankester. On the Evolution of Hæmoglobin, by H. C. Sorby.

The Monthly Microscopical Journal. — January. Improved Method of Applying the Micro-Spectroscopic Test for Blood-Stains, by J. G. Richardson.

The Popular Science Review. — January. In the Wake of the Challenger, by J. G. Galton. The Cretaceous Flora, by J. Morris.

The Geological Magazine. — January. Contributions to the Study of Volcanoes, by J. W. Judd. Geology of Ice and Bell Sounds, Spitzbergen, by A. E. Nordenskiöld.

Zeitschrift für wissenschaftlich Zoölogie. — December 8, 1875. Natural History of the Marine Bryozoa, by W. Repiachoff. Anatomy of *Chætoderma nitidulum*, by L. Graff. On the Order *Gastrotricha*, by H. Ludwig.

Archiv für mikroskopische Anatomie. — November 20, 1875. On the Tegument of Amphibia, by F. Leydig. On the Anatomy of *Amphioxus lanceolatus*, by P. Langerhans.

Archives de Zoölogie expérimentale et générale. — No. 3, 1875. Researches on the Free Helminths of the Coast of Brittany, by A. Villot. Contributions to a History of the Gregarinæ of Invertebrates of Paris and Roscoff, by A. Schneider. On the Development of Poduræ, by Oulganin (notice by the editor).

Petermann's geographischer Mittheilungen. — November 10, 1875. Stanley's Exploration of Victoria Nyanza, by E. Behm. Nordenskiöld's New Route by Sea from Europe to Siberia.

[1] The articles enumerated under this head will be for the most part selected.